Brief instructions : ALF-5001

BOSCH system : EI-K

Vehicle make : ALFA ROMEO

Basic microcard : PKW-030

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SPECIAL FEATURES

These brief instructions, valid at the time of publication, apply to the following Alfa Romeo model:

Alfa 75 Turbo, engine 061.34, year of manufacture 1986 Europe, Switzerland.

* EI-K control unit 0 227 400 024
* Trigger box 0 227 100 111
* Ignition coil 1 227 020 010
* Self-diagnosis (flashing code)
* Characteristic-map change-over
* Charge-air-pressure control

STRUCTURE, USAGE

These brief instructions contain essentially vehicle-specific special features and set values.

Corresponding to the customer complaint, the trouble-shooting chart leads to various causes/ component faults.
Detailed information for trouble-shooting must be taken from the basic instructions via the trouble-shooting chart.

NOTE :
Even if reference is made to basic instructions, the set values, terminal assignments and special features of these vehicle-related brief instructions are always binding.

SAFETY AND PRECAUTIONARY MEASURES

Keep people out of danger.
Avoid damage to the engine, trigger box and control unit or ignition system.

* A T T E N T I O N !
High-performance ignition system.
Dangerous high and low voltages.

Do not make contact with parts or terminals which carry voltage; danger, primary and secondary ends.

* When testing compression, disconnect trigger-box plug or f i r m l y apply ignition coil term.4 to ground using auxiliary cable.

N o t e :
Auxiliary cable must be interference-suppressed by at least 2k Ω .

See basic instructions for further precautionary measures.

TROUBLE-SHOOTING CHART

Customer complaint (fault symptoms)

1. Starting motor turns, engine fails to start or starts only with great difficulty.	2. Engine starts but then dies.	3. Uneven engine idle (speed, exhaust).	4. Poor throttle response.	5. Engine misfiring (ignition, injection).	6. Engine lacks power/ maximum speed too low.	7. Fuel consumption too high.	8. Engine diesels.	9. Engine pings/knocks.	10. Engine becomes too hot.	11. Fault lamp.	Cause (component fault)
*	*	*	*	*	*	*	*	*	*	*	Self-diagnosis
*		*	*	*							High-voltage end
*		*	*	*							Ignition coil
*											Firing sequence
*											Voltage, trigger box
*											Voltage, primary circuit
*											Voltage, EI-K control unit
*											Ignition-distributor plug and socket
*											Voltage, magnetic pulse generator
*											Magnetic pulse generator, operation
*											EI-K control unit, operation
*											Ignition-distributor, adjustment on assembly

TROUBLE-SHOOTING CHART (CONTINUED)

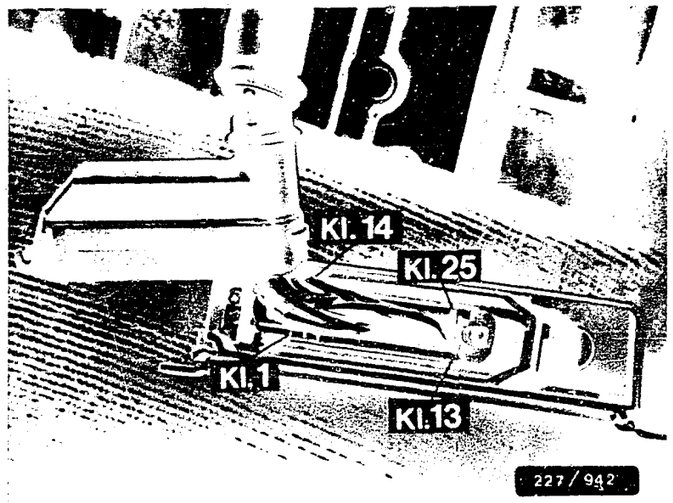
Customer complaint (fault symptoms)

1. Starter turns, engine fails to start or starts only with great difficulty.	2. Engine starts but then dies.	3. Uneven engine idle (speed, exhaust).	4. Poor throttle response.	5. Engine misfiring (ignition, injection).	6. Engine lacks power/ maximum speed too low.	7. Fuel consumption too high.	8. Engine diesels.	9. Engine pings/knocks.	10. Engine becomes too hot.	11. Fault lamp.	Cause (component fault)
*											Speed signal (Jetronic)
*				*							Contact resistances
										*	Fault lamp
		*	*		*	*					Idle throttle-valve switch
		*	*		*	*		*	*	*	Basic ignition setting
					*	*			*		Fuel enrichment
			*		*	*		*	*		Charge-air-pressure timing valve
				*							Voltage, trigger box
				*							Voltage, ignition coil
				*							Primary voltage

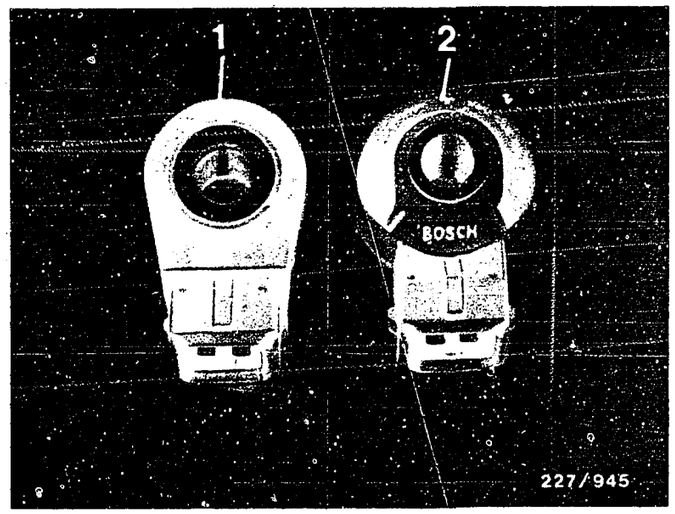
For production reasons: continued on the following coordinate.

SELF–DIAGNOSIS TEST CHART

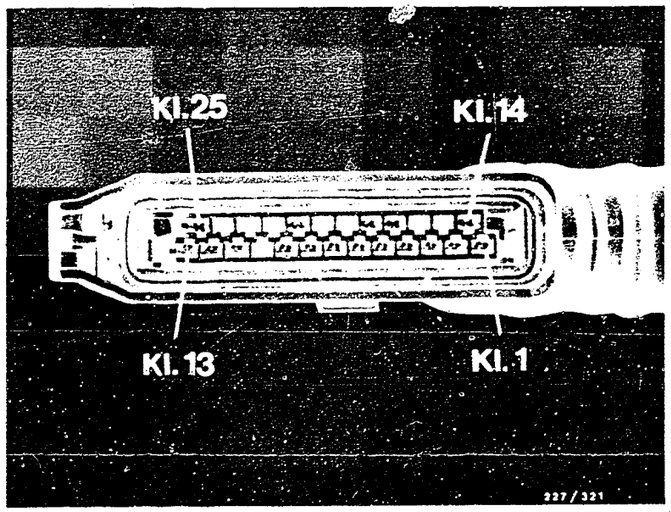
Fault indication Flashing code	Testing of components / function Test instructions / conditions	Terms.	Set values
1 1	MAXIMUM RETARDATION OF KNOCK CONTROL OBTAINED. Octane rating of fuel too low. Test valve clearance, overpressure valve of exhaust turbo–supercharger, fuel–injection system. Main–bearing damage or abnormal engine noises.	——	——
1 2	VOLTAGE SUPPLY, EI–K CONTROL UNIT Engine at idle. Voltage at EI–K control–unit plug with handle cover removed. See upper illustration.	6 20 (+) (–)	equal to / greater than 10.5 V
2 1/ 2 2	KNOCK SENSOR Visual examination, knock–sensor plug for oxidation. Resistance, EI–K control–unit plug (not applicable for "new" version). Tightening torque, "old" version. "new" version. See lower illustration for versions.	 12 13	 270...370 Ω 11...15 Nm 15...25 Nm
2 3	EI–K CONTROL UNIT, KNOCK–EVALUATION CIRCUIT. Replace EI–K control unit.	——	——
3 1	LOAD SIGNAL Engine at idle. Dwell angle, EI–K control–unit plug with handle cover removed. See upper illustration. Read off dwell angle. Briefly apply full throttle. Read off dwell angle.	8 B– (+) (–)	 Noticeable change of dwell angle

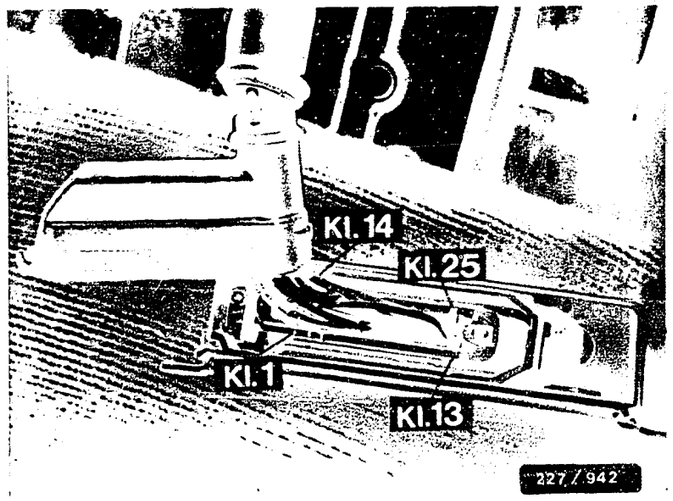


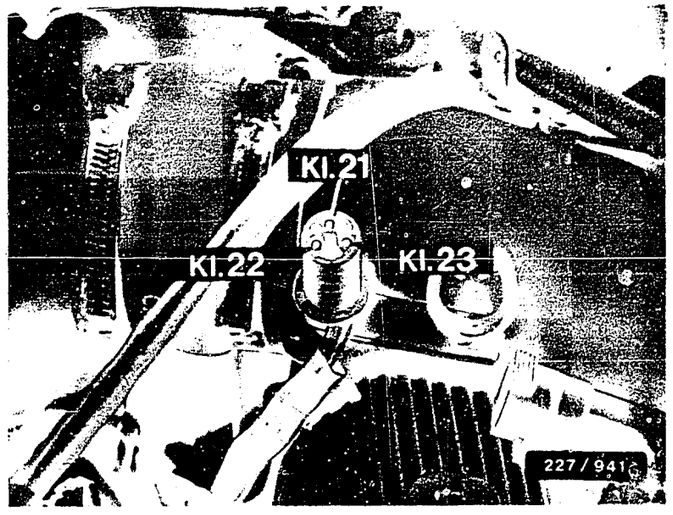
1 = Old version
2 = New version



Fault indication Flashing code	Testing of components / function Test instructions / conditions	Terms.	Set values
4 1	ANGLE-OF-ROTATION SENSOR, INPUT VOLTAGE TOO LOW. Disconnect EI-K control-unit plug. Pull apart angle-of-rotation-sensor plug connection. 1. Voltage, battery and EI-K control-unit plug. See upper illustration. 2. Connect angle-of-rotation-sensor plug. Ignition ON. Voltage, EI-K control-unit plug (connected) with handle cover removed. See center illustration. 3. Voltage, EI-K control-unit plug. The voltage measured at point 2 multiplied by 0.21 gives set value. If necessary, adjust angle-of-rotation sensor. Note: At points 2 and 3, use only voltmeter with Ri greater than 100k Ω and resolution of 10 mV.	B+ 22 (+) (-) 21 23 (+) (-) 22 23 (+) (-)	0 V 3.5...4.5 V Voltage at point 2 x 0.21
4 2	ANGLE-OF-ROTATION SENSOR, INPUT VOLTAGE TOO HIGH Resistance, EI-K control-unit plug. See upper illustration. Pull apart angle-of-rotation-sensor plug connection. Ignition ON. Voltage, angle-of-rotation sensor plug. See lower illustration.	21 22 22 B- (+) (-)	3.2...4.8 k Ω 0 V

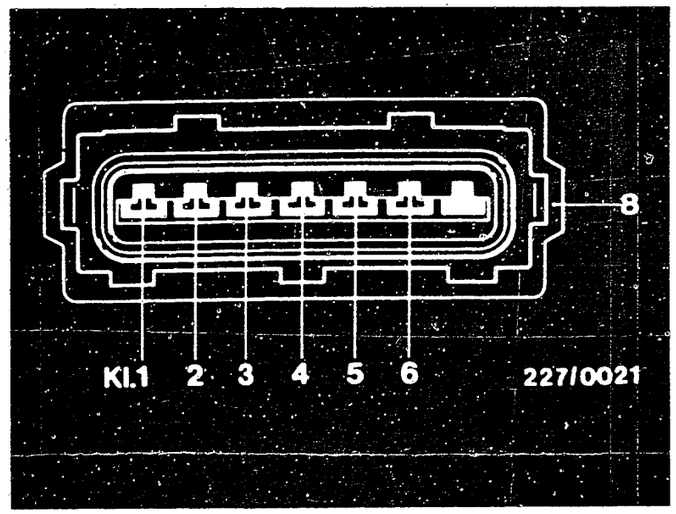






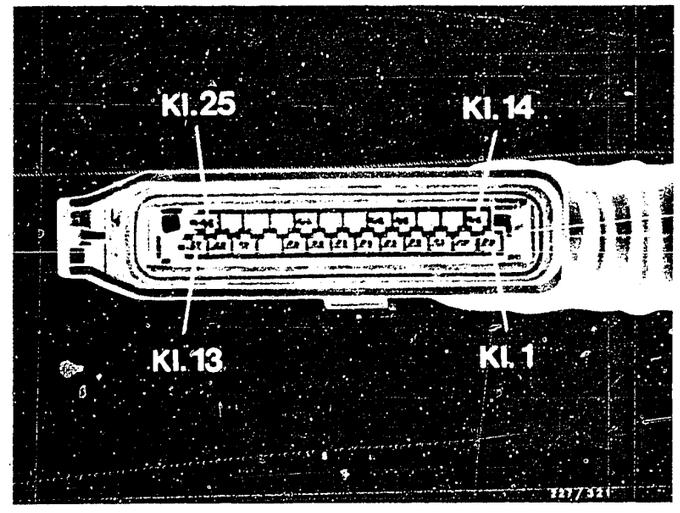
RAPID DIAGNOSIS CHART

Test step	Testing of components / function Test instructions / conditions	Terms.	Set values
1	HIGH VOLTAGE END Test operation of e.g. spark plugs, ignition harness, distributor cap (e.g. open circuit, shunt). Assessment, for example, by ignition oscillogram, resistance measurement, visual check.	——	——
2	IGNITION COIL Resistance, primary Resistance, secondary	 1 15 1 4	 0.7... 1.2 Ω 6.9...11.9 k Ω
3	VOLTAGE SUPPLY, TRIGGER BOX Disconnect trigger-box plug. Ignition ON. Voltage, trigger-box plug. See upper illustration.	 4 2 (+) (−)	 Battery voltage
4	VOLTAGE SUPPLY, PRIMARY CIRCUIT Ignition ON. Voltage, trigger-box plug. See upper illustration.	 1 2 (+) (−)	 Battery voltage
5	VOLTAGE SUPPLY, EI-K CONTROL UNIT Disconnect EI-K control-unit plug. Ignition ON. Voltage, EI-K control-unit plug. See lower illustration.	 6 20 (+) (−)	 Battery voltage



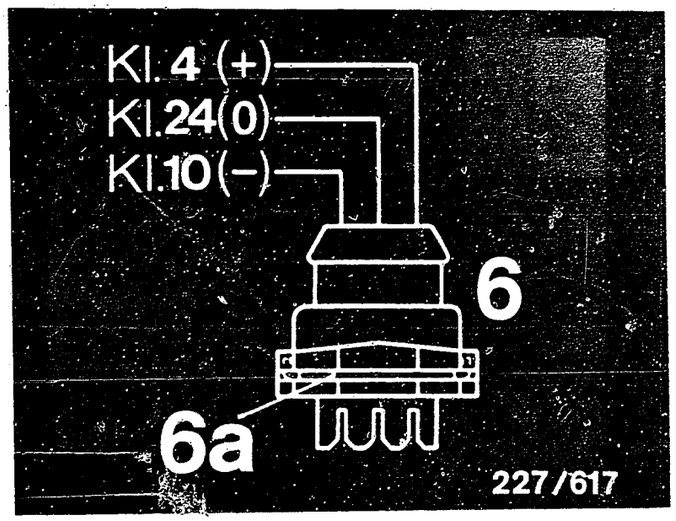
8 = Trigger-box plug

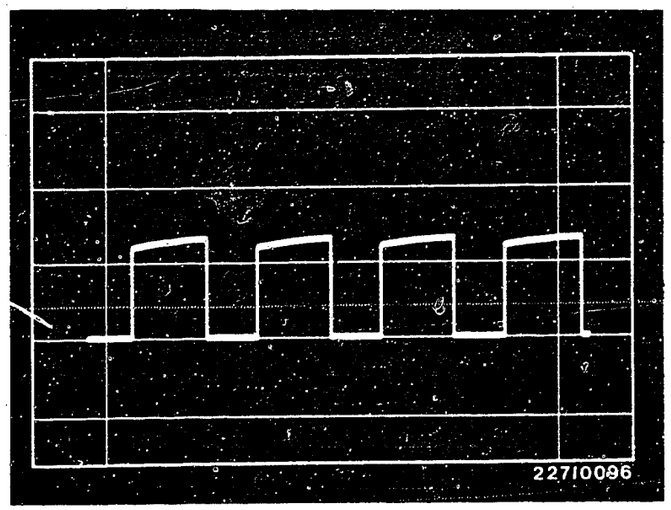
EI-K control-unit plug

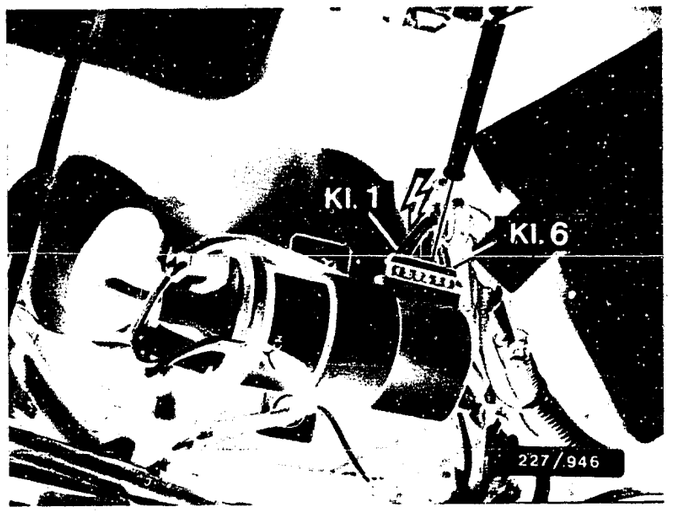


Test step	Testing of components / function Test instructions / conditions	Terms.	Set values
6	MAGNETIC PULSE GENERATOR Visual check, ignition-distributor plug and socket for oxidization.	——	——
7	VOLTAGE SUPPLY, MAGNETIC PULSE GENERATOR Connect ignition-distributor plug and EI-K control-unit plug. Ignition ON. Voltage at ignition-distributor plug. See upper illustration.	4 10 (+) (–)	equal to/greater than 10 V
8	MAGNETIC PULSE GENERATOR – OPERATION Start engine. "Special" oscilloscope to ignition-distributor plug. See upper illustration.	24 B– (+) (–)	Rectangular pulse (center illustr.)
9	EI-K CONTROL UNIT – OPERATION Connect trigger-box plug. Start engine. "Special" oscilloscope to trigger-box plugs in turn. See lower illustration.	5 B– (+) (–) 6 B– (+) (–)	Rectangular pulse (center illustr.)
10*	IGNITION DISTRIBUTOR – ADJUSTMENT ON ASSEMBLY Cyl. 1 of engine at TDC. Center of distributor rotor points to marking on housing.	——	——

* Perform only when engine not running.



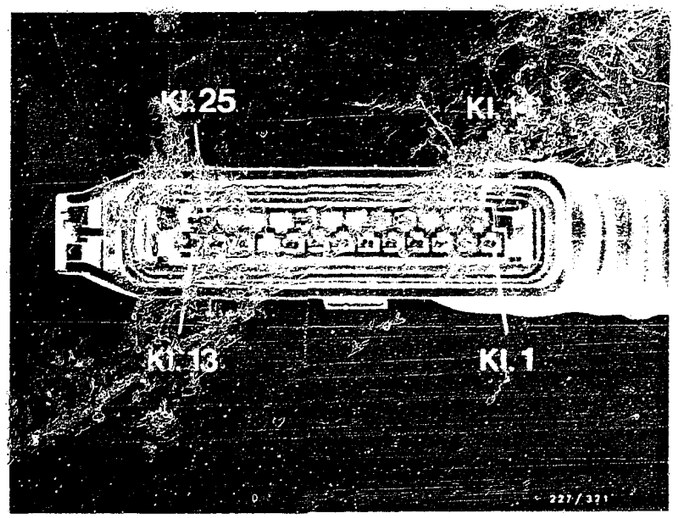


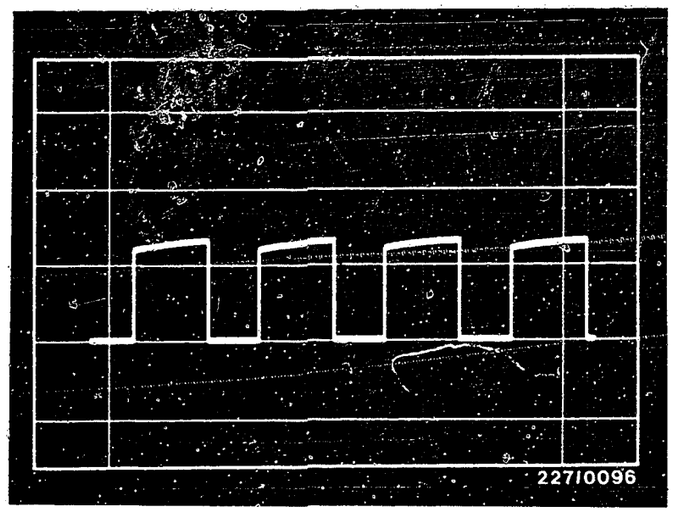


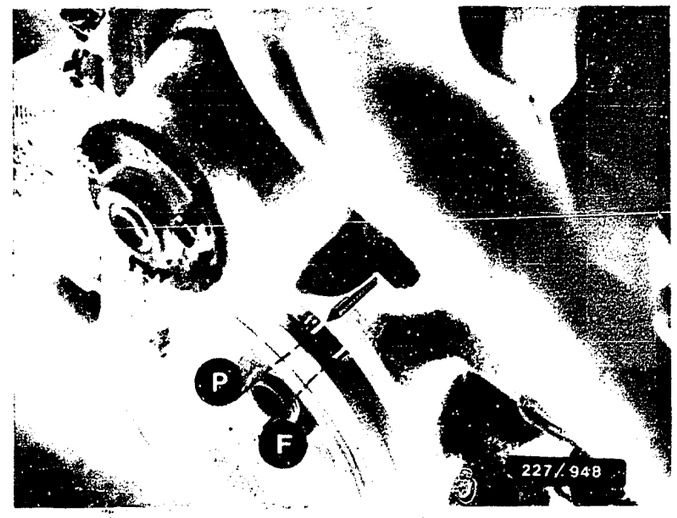
RAPID DIAGNOSIS CHART (CONTINUED)

Test step	Testing of component/function Test instructions/conditions	Termi-nals	Set values
11*	ENGINE-SPEED SIGNAL Disconnect Jetronic control-unit plug. See upper illustration. Start engine. Oscilloscope "Special" to Jetronic control-unit plug.	1 B- (+)(-)	Rectangular pulse (center illustration)
12*	CONTACT RESISTANCES Test voltage-supply leads from trigger box and primary circuit for contact resistance.	Var-ious	Max. 0.3 Ω (per current circuit)
13	FAULT LAMP Connect Jetronic control-unit plug. Ignition ON. Self-diagnosis switch ON. Engine at idle.		 Fault lamp lights Fault lamp OFF / flashes
14	THROTTLE-VALVE SWITCH - IDLE Engine at normal operating temperature. Engine at approx. 3000 min^{-1} . Read off spark-advance angle. Close idle throttle-valve switch by hand (as far as it will go).	——	 Spark-advance-angle change
15	BASIC IGNITION SETTING Disconnect both throttle-valve-switch plugs (idle) and jump using auxiliary lead. Run engine at 850...950 min^{-1} . Marking P = TDC, F = 9° before TDC. See lower illustration.	——	 9 ± 1 ° before TDC

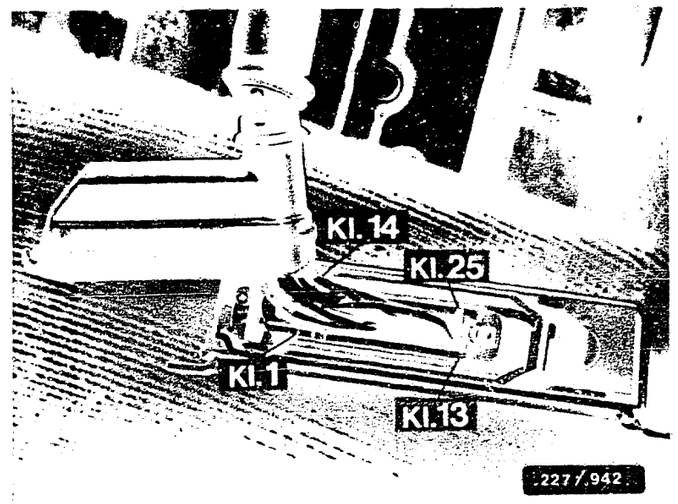
*Perform only when engine is not running.

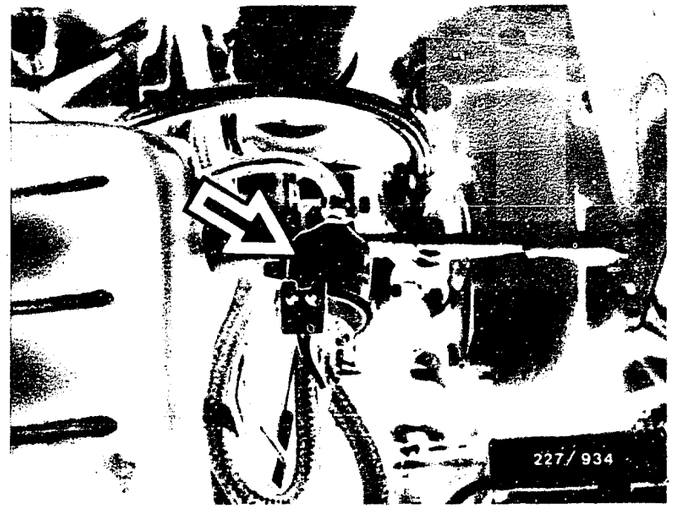


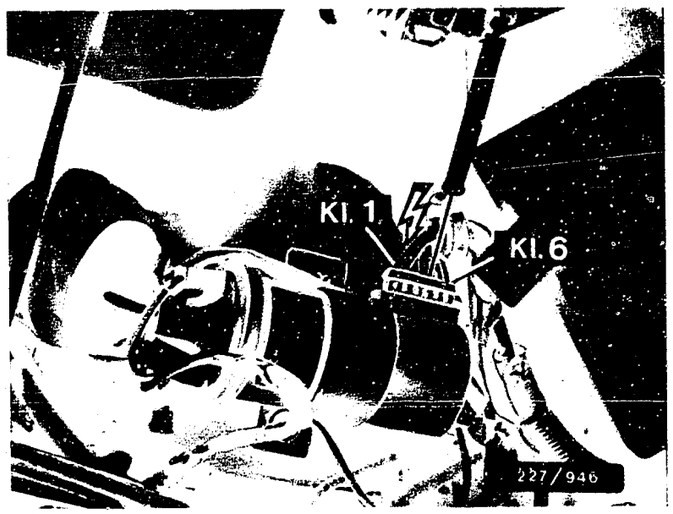




Test step	Testing of components / function Test instructions / conditions	Terms.	Set values
16	FUEL ENRICHMENT Bridge EI-K control-unit plug with handle cover removed using auxiliary lead. See upper illustration. Engine at idle. Voltage, EI-K control-unit plug.	21 22 18 B- (+) (-)	0 V up to max. 1 V
17	CHARGE-AIR-PRESSURE TIMING VALVE Bridge EI-K control-unit plug with handle cover removed using auxiliary lead. See upper illustration. Run engine at approx.2500 min $^{-1}$.	21 22	Timing valve operating (feelable) Center illustration
18	VOLTAGE SUPPLY, TRIGGER BOX Engine at idle. Voltage, trigger-box plug. See lower illustration.	4 2 (+) (-)	12...14 V max. 1V below U_B
19	VOLTAGE SUPPLY, IGNITION COIL Engine at idle. Voltage, ignition coil and battery.	15 B- (+)(-)	equal to /greater than 10 V
20	PRIMARY VOLTAGE Engine at idle. Oscilloscope with pulse shaper at ignition coil	various	290...370 V







Voltage supply EI-K control unit with engine at idle	equal to/greater than 10.5 V
Knock sensor "OLD" Knock sensor "NEW"	270...330 k Ω ———
Tightening torque: Knock sensor "OLD" Knock sensor "NEW"	 11...15 Nm 15...25 Nm
Angle-of-rotation sensor Term.21 and term.22	3.2...4.8 k Ω
Ignition coil, primary Ignition coil, secondary	0.7... 1.2 Ω 6.9...11.9 k Ω
Voltage supply trigger box with ignition ON	Battery voltage
Voltage supply primary circuit with ignition ON	Battery voltage
Voltage supply EI-K control unit with ignition ON	Battery voltage
Voltage supply magnetic pulse generator with ignition ON	equal to/greater than 10 V

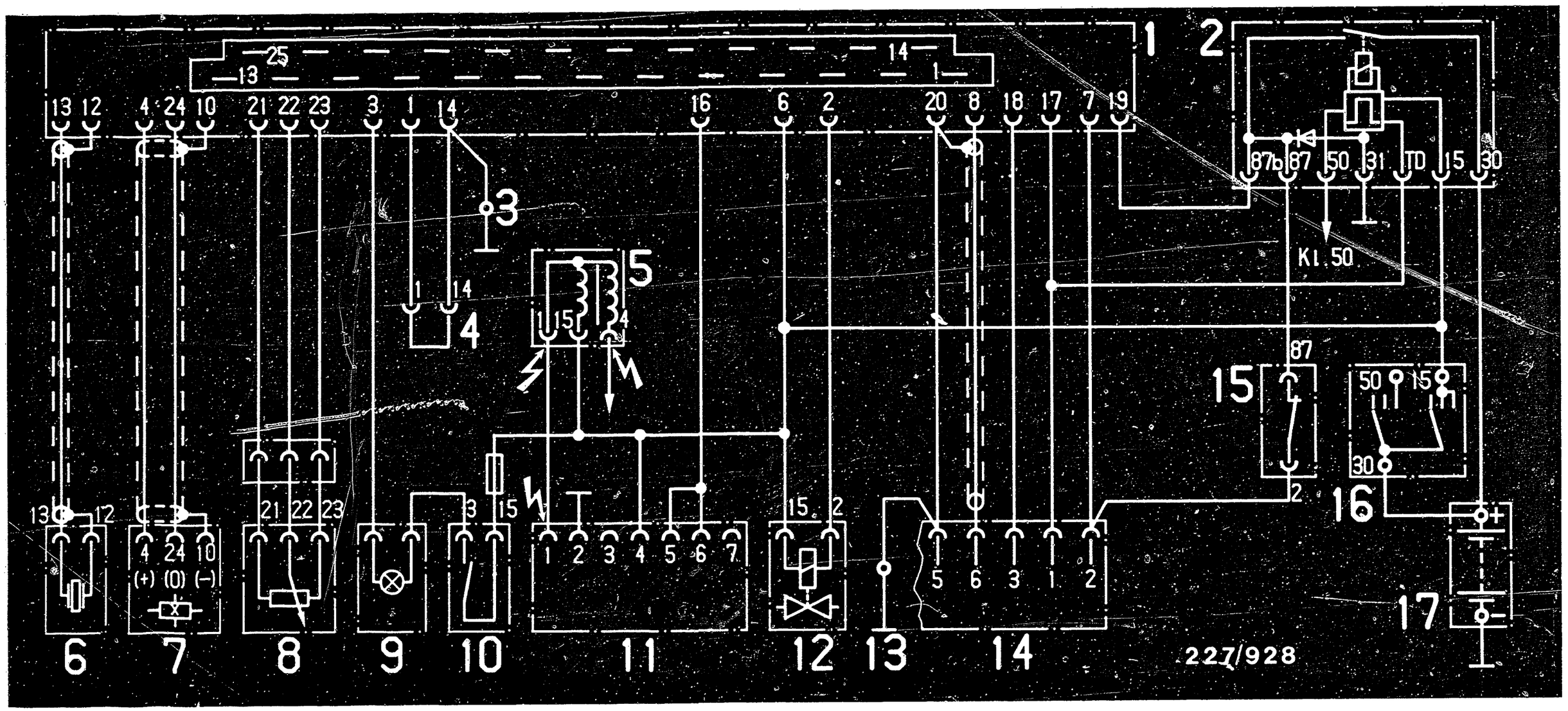
Magnetic pulse generator - operation at cranking speed	Rectangular pulse
EI-K control units - operation at cranking speed	Rectangular pulse
Ignition distributor - adjustment on assembly	Cyl.1 at TDC Ign.-distr. marking
Speed signal at cranking speed	Rectangular pulse
Contact resistance supply leads, trigger box and primary circuit	max. 0.3 Ω (per current circuit)
Fault lamp Ignition ON engine at idle	 lights OFF/ flashes
Basic ignition setting throttle-valve switch bridged	9 ± 1° before TDC at 850... 950 min $^{-1}$
Fuel enrichment engine at idle	0 V up to max. 1V

TEST SPECIFICATIONS (continued)

Charge-air-pressure timing valve EI-K control-unit plug term.21 and term.22 bridged run engine at approx.2500 min $^{-1}$	Timing valve operating (feelable)
Voltage supply trigger box with engine at idle	12...14 V max. 1 V below V_B
Voltage supply ignition coil with engine at idle	equal to/greater than 10 V
Primary voltage with engine at idle	290...370 V

See SIS microcard Jetronic and/or Autodata test specifications for settings for idle speed, exhaust gas, valve clearance, etc.

For production reasons:
continued on the following
coordinate.



High-voltage symbols: Danger 400 V...25 kV

1 = EI-K control-unit plug
2 = Electric-fuel-pump relay
3 = Ground (intake manifold, rear)
4 = Characteristic-map change-over
5 = Ignition coil
6 = Knock sensor
7 = Magnetic pulse generator
8 = Angle-of-rotation sensor
9 = Fault lamp
10 = Self-diagnosis switch
11 = Trigger box
12 = Charge-air-pressure timing valve
13 = Ground (valve cover, right, at auxiliary-air device)
14 = KE-Jetronic control unit
15 = Idle throttle-valve switch
16 = Ignition and starting switch
17 = Battery

ELECTRICAL TERMINAL DIAGRAM

A23 — ⟹ A24 — ⟸

INSTALLATION POSITION OF COMPONENTS

The EI-K control unit is positioned in the passenger compartment at the front on the right.

The Jetronic control unit is positioned in the footwell on the front passenger's side.

Ignition coil, trigger box and electric-fuel-pump relay are positioned at the side web plate at the front on the right (near to battery).

Idle throttle-valve switch and angle-of-rotation sensor are positioned on the throttle body (throttle-valve assembly).

Charge-air-pressure timing valve is positioned on the air-filter housing.

Knock sensor is positioned on the cylinder head (near to starting motor).

Self-diagnosis switch and fault lamp are positioned in the on-board instrument panel.

For production reasons: continued on the following coordinate.

Trouble-shooting instructions : VWW-5011

BOSCH system : Motronic (Digifant)

Make of vehicle : VOLKSWAGEN

Basic microcard : PKW-046

TABLE OF CONTENTS

SPECIAL FEATURES

These trouble-shooting instructions, valid at the time of publication, apply to the following vehicle models:

* VW Polo 05.87->
  with 1.3 l / 4 cyl./ 85 kW
  G-supercharger engine (Turbo), without catalytic converter

Special features:

- 85 kW (115 bhp) engine, code letters "PY"
- Charging system with G-supercharger and charge-air cooling
- Crankshaft speed and position are detected by way of a "Hall generator" (no engine-speed and reference-mark sensor)
- Control unit with 25-pole connector
- Knock control

STRUCTURE AND USAGE

These brief instructions encompass essentially vehicle-specific special features and test specifications (set values).

In accordance with the customer complaint, the trouble-shooting chart leads to different causes/component faults.
For a detailed description of trouble-shooting, see the information in the trouble-shooting chart of the basic instructions.

ATTENTION: Even if reference is made to basic instructions, the set values, terminal assignments and special features of these vehicle-related brief instructions are always binding.

SAFETY AND PRECAUTIONARY MEASURES

In order to keep persons out of danger and to avoid damage to the engine, trigger boxes and control units or to the ignition system, observe the information in the basic instructions.

CAUTION!
High-performance ignition system with dangerous primary and secondary voltages!

Touching voltage-carrying components or terminals may prove fatal (both on the primary and secondary sides).

* Avoid injection of fuel and high-voltage flashovers when testing the compression.
Therefore, disconnect Motronic relay.

TROUBLE-SHOOTING CHART

Customer complaint (fault symptoms)

1. Starting motor operates, engine fails to start or starts only with difficulty.
2. Engine starts but then dies.
3. Idle problems (engine speed, exhaust gas).
4. Poor throttle take-up, flat spot during acceleration.
5. Engine missing (ignition, injection).
6. Maximum engine power/ top speed not reached.
7. Fuel consumption too high.
8. Engine running on (dieseling).
9. Engine pinging/knocking.
10. Engine overheating.
11. Fault lamp.

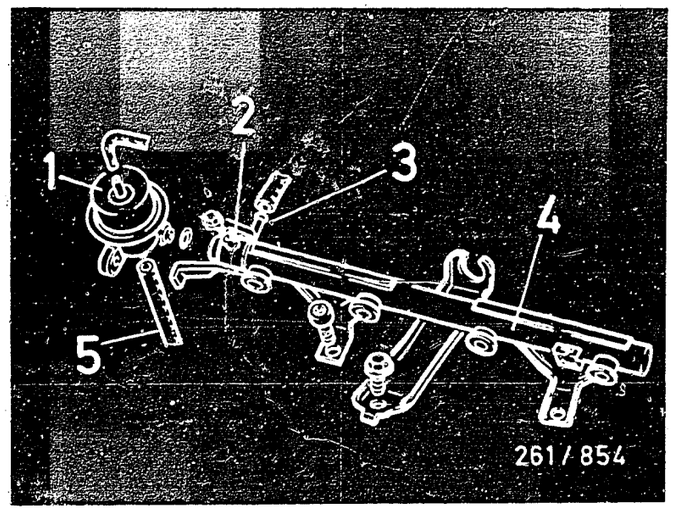
1	2	3	4	5	6	7	8	9	10	11	Cause (component fault)
*											Voltage at control unit
*				*							Magnetic pulse generator
*		*			*	*					Fuel pressure
				*	*						Fuel delivery
*		*				*	*				Solenoid-operated injection valves
		*			*						Throttle valve
		*	*		*						Throttle-valve switch
		*									Overrun cutoff
	*	*	*								Auxiliary-air device
		*									Idle speed, CO
*	*	*	*								Air intake system
*	*	*	*	*	*	*					Air-flow sensor
					*	*					Temperature sensor (air)
*	*	*	*	*	*	*					Temperature sensor (engine)
			*		*	*		*			Knock sensor
*		*		*	*						Ignition coil
*		*	*	*	*						Primary signal
		*	*	*	*	*					Secondary pattern
*	*	*	*		*	*	*	*	*		Ignition angle
		*	*	*							Interference-suppression resistors
				*	*						Interference
*	*	*	*	*	*	*		*	*		Control unit

RAPID DIAGNOSIS CHART

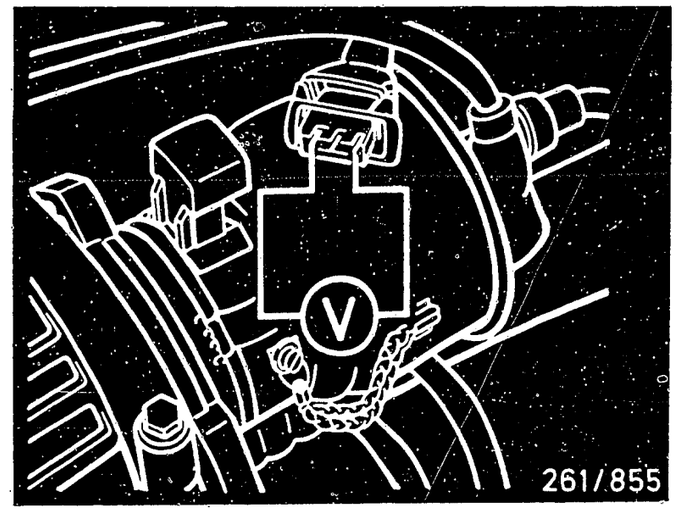
Test step	Testing of component/ function	Test instructions/ test conditions	Con-trol-unit terms.	Set values
1	Leads to magnetic pulse generator (Hall generator)	Put into neutral, switch off ignition, detach Digifant control unit and control unit of idle-speed regulation as well as pump relay. Detach plug at ignition distributor and jumper all three connections. Use test prods to measure resistance at open control-unit plug (25-pole). Caution: do not damage spring contacts!	8, 6 and 18, 6	approx. 0 Ω (continuity)
2	Temperature sensor (intake air)	Resistance at +15...+30°C:	9, 6	1,45...3,3 k Ω
3	Temperature sensor (coolant)	Resistance at +15...+30°C: with engine at operating temperature:	10, 6	1,45...3,3 k Ω 280...360 Ω
4	Throttle-valve switch (idle contact)	Accelerator pedal not depressed: Accelerator pedal slightly depressed (part-load range):	11, 6	approx. 0 Ω (continuity) gr.than 1 M Ω
5	Throttle-valve switch (full-load contact)	Fully depress accelerator pedal (full-load stop): Slowly release accelerator pedal:	11, 6	approx. 0 Ω (continuity) gr.than 1 M Ω
6	Air-flow sensor (overall resistance)	Measure resistance:	17, 6	500...1100 Ω
7	Air-flow sensor (wiper)	Slowly deflect sensor flap as far as it will go:	21, 6	8...2500 Ω
8	Injection valves (4)	Winding resistance at +15...+30°C: Note: Only connect one injection valve alternately in each case.	12, 14	15...17,5 Ω
9	Main relay + leads	Voltage measurement, switch measuring range! Voltage supply for control unit. Switch on ignition:	14, 13 and 14, 19	10...15 V

RAPID DIAGNOSIS CHART (CONTINUED)

Test step	Testing of component/function Test instructions/conditions	Con-trol-unit terms.	Set values
10	Pump relay + leads; actuation of electric fuel pump. Switch on ignition:	3, 13	10... 15 V
11	Fuel pressure Switch off ignition, connect pressure gauge at test connection or fuel inlet of fuel-distribu-tion pipe (top picture, item 2 or 3). Switch on ignition, jumper term. 3 and term. 13 in control-unit plug. Electric fuel pump must be heard to start up:	———	2,3...2,7 bar
12	Lead to term. 50 (starting motor). Start signal. Put into neutral and start:	1, 13	8... 15 V
13	Ignition coil (primary winding) with leads Switch on ignition:	25, 13	10... 15 V
14	Digifant control unit. Voltage supply for magnetic pulse generator. Connect control unit, detach plug at ignition distributor and measure voltage at outer con-tacts of plug (bottom picture). Switch on ignition:	8, 6	10... 15 V
15	Magnetic pulse generator, switching function. As above, however re-connect plug, push back rubber sleeve of plug and test voltage profile with oscilloscope (special input) at center connection (0) and vehicle ground (bottom picture). Start engine:	18, 6	Rectangular signal

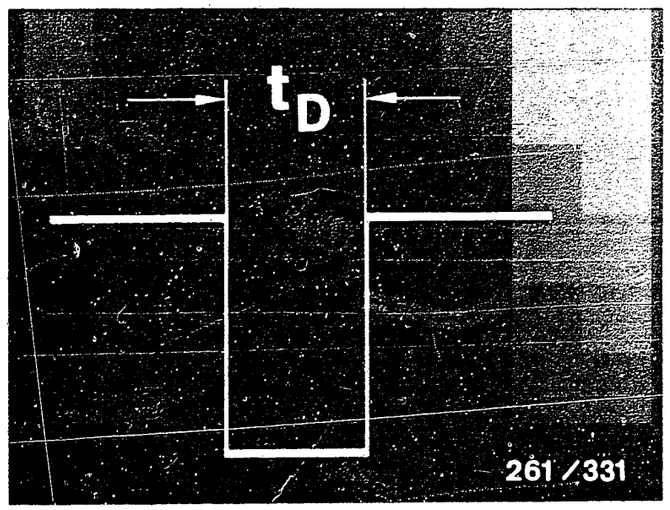


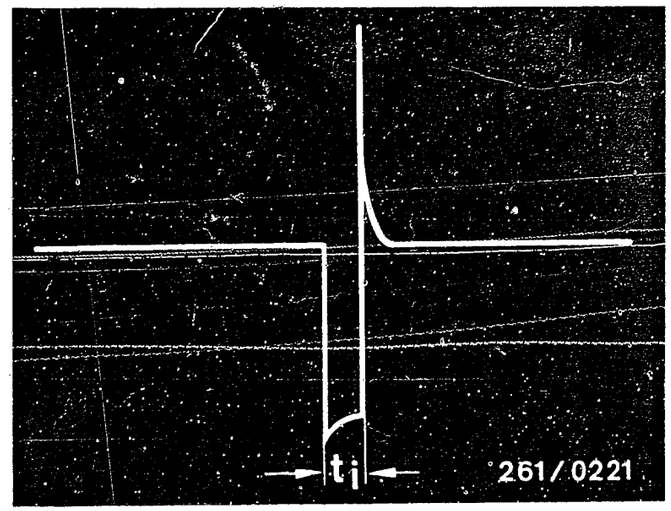
1 = Fuel pressure regulator
2 = Test connection for pressure gauge
3 = Fuel inlet
4 = Fuel-distribution pipe
5 = Fuel return line

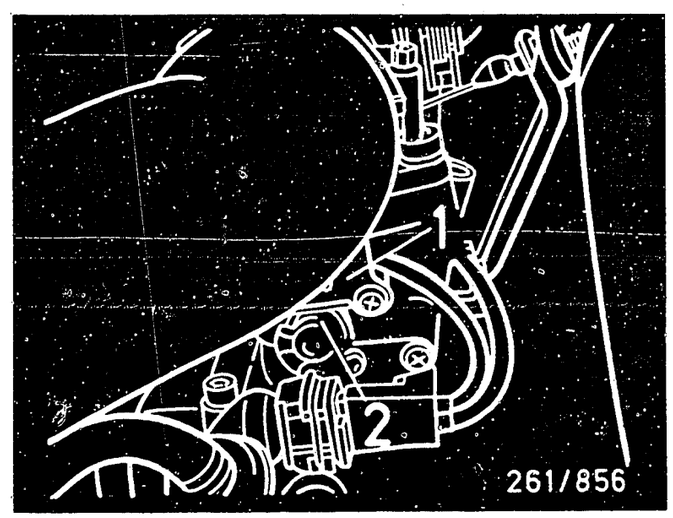


RAPID DIAGNOSIS CHART (CONTINUED)

Test step	Testing of component/function Test instructions/conditions	Con-trol-unit terms.	Set values
16	Dwell-period signal Test with oscilloscope (special input) at term. 1 of ignition coil Put into neutral and start.	25, ground	See top picture
17	Injection signal Test with oscilloscope at joint injection-valve plug (bottom picture, item 2) (test lead 1 684 463 093). Put into neutral and start.	14, 12	See center picture
18	Voltage supply for air-flow sensor Push back rubber sleeve at air-flow-sensor plug and measure voltage between connection 3 and 4 with test prods. Switch on ignition.	17, 6	greater than 4,5 V
19	Air-flow sensor (wiper) As above, however measure between connection 2 and 4.	21, 6	Sensor flap in off position: 0,2...0,3 V Fully deflect sensor flap: gr. than 4,2 V
20	Overrun cutoff Remove cover from full-load switch (bottom picture, Item 1). Start engine, increase engine speed to approx. 2500 min $^{-1}$ and actuate full-load contact (bottom picture, Item 2) (idle contact and full-load contact are connected in parallel).	——	(Operating tempera-ture) engine hunts
21	Leads to knock sensor Disconnect plug connection to knock sensor and jumper all three connections in plug. Measure resistance in control-unit plug:	5, 4 and 7, 4	approx. 0 Ω (continuity)

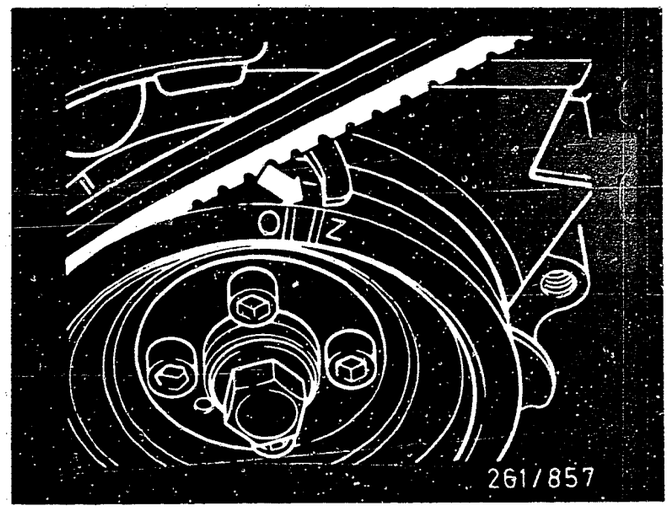


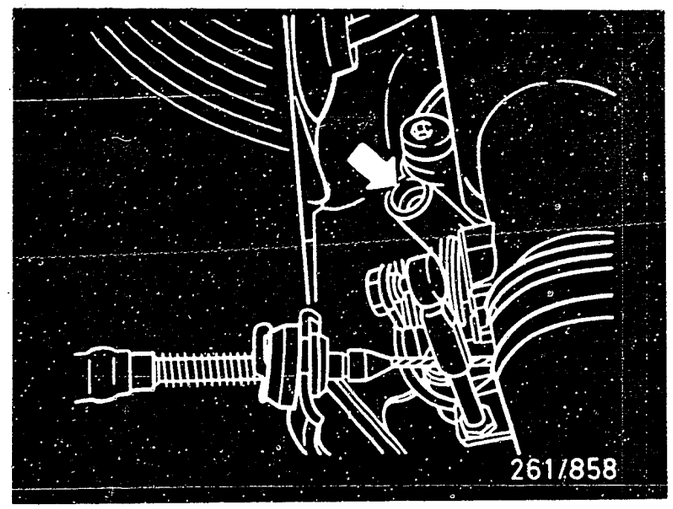


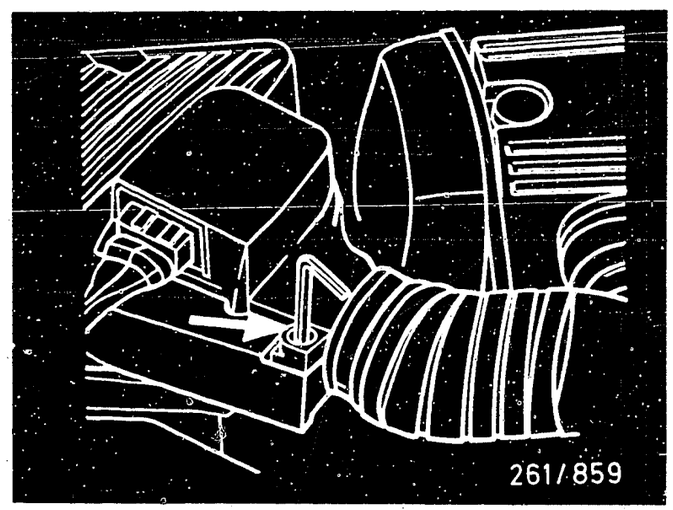


RAPID DIAGNOSIS CHART (CONTINUED)

Test step	Testing of component/function Test instructions/conditions	Con-trol-unit terms.	Set values
22	Test ignition angle (basic value). Engine at operating temperature, plug of temperature sensor (engine) detached. Engine speed 2000...2500 min $^{-1}$: See top picture, arrow.	———	Basic value 3...7 °CS
	Re-attach plug of temperature sensor (engine). Engine speed approx. 2500 min $^{-1}$.		Adjustment value 18...28 °CS
	Note: If adjustment value is 10°CS smaller than set value, test knock sensor (see "Test specifications") and re-determine ignition angle. Renew knock sensor if necessary.		
23	Idle speed and CO (center picture, arrow and bottom picture). Connect engine and CO tester Engine at operating temperature, loads switched off, clamp crankcase breather hose together and remove closing cover from cylinder head cover. Note: Values must remain within tolerance after attaching temperature sensor.	———	850...950 min $^{-1}$ 0,5...1,5 vol.%CO





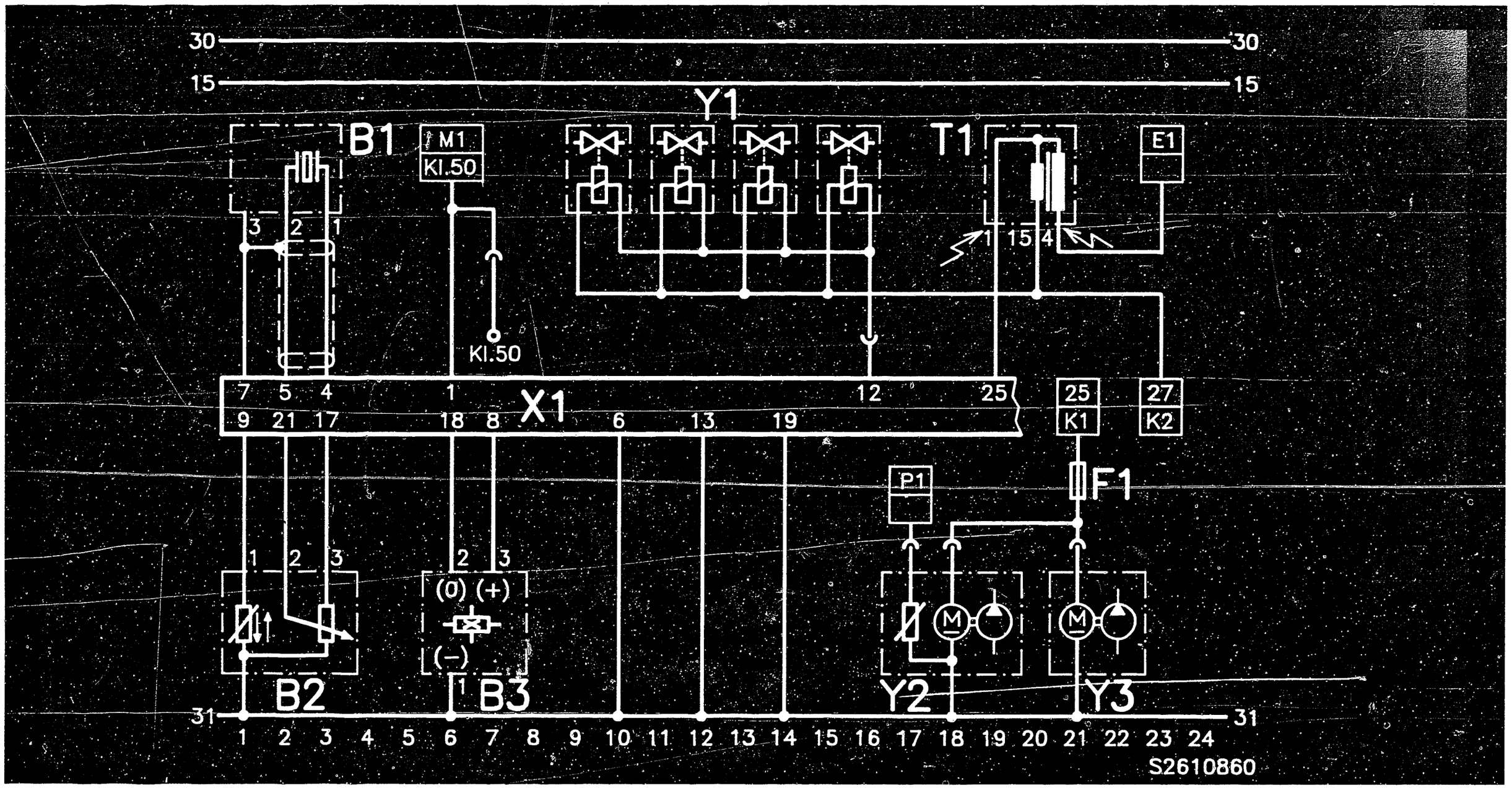


Idle-speed adjustment		
* Idle speed:		850...950 min $^{-1}$
Exhaust-gas setting		
* CO value with engine idling at operating temperature		0,5...1,5 vol. %
Pressure regulator		
* Fuel pressure:		2,3...2,7 bar
Electric fuel pump		
* Delivery (measured in return line)		
Fuel pump:	min.	650 cm ^{3} /30s
Pre-supply pump:	min.	720 cm ^{3} /30s
* Supply voltage (under load):	min.	12 V
Temperature sensor (engine)		
* Internal resistance at ambient temperature (+15°C...+30°C):		1,45...3,3 k Ω
Engine at operating temperature (approx. +80°C):		280...360 Ω
Solenoid-operated injection valve		
* Internal resistance at ambient temperature (+15°C...+30°C):		15...17,5 Ω
Auxiliary-air device		
* Internal resistance:		40...75 Ω
Knock sensor		
* Internal resistance:	greater than	1 M Ω
Tightening torque: (Loosen screw first when checking)		15...25 Nm

Air-flow sensor	
* Internal resistance	
between term. 2 and term. 4:	8...2500 Ω (1)
between term. 3 and term. 4:	500...1100 Ω

(1) = Slowly deflect sensor flap as far as it will go. Fluctuating increase in resistance, drops off slightly towards end.

Temperature sensor (air)	
* Internal resistance measured at air-flow sensor between term. 1 and term. 4 at ambient temperature (+15°C...+30°C):	1,45...3,3 k Ω
Ignition coil	
* Primary resistance (term.1/term.15):	0,5...0,8 Ω
* Secondary resistance (term.1/term.4):	2,4...3,5 k Ω
Interference-suppression resistors	
* Ignition-distributor rotor:	0,6...1,4 k Ω
* Distributor cap :	0,6...1,4 k Ω
* Spark-plug connector :	4,0...6,0 k Ω

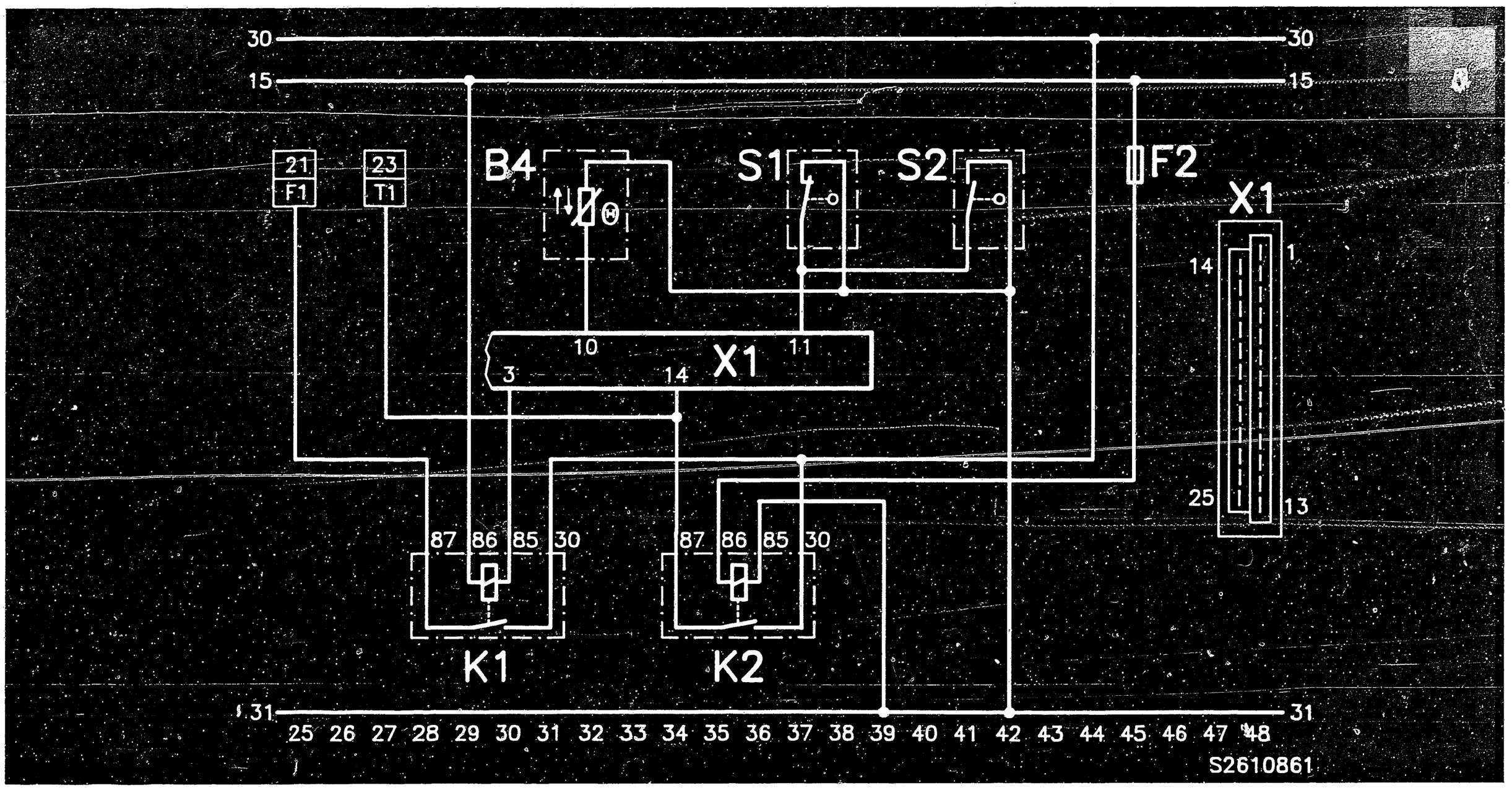


B1= Knock sensor
B2= Air-flow sensor
B3= Mag. pulse generator (Hall generator)
E1= High-tension distributor
F1= Pump fuse (No. 1)

K1= Pump relay
K2= Main relay
M1= Starting motor
P1= Fuel gauge
T1= Ignition coil

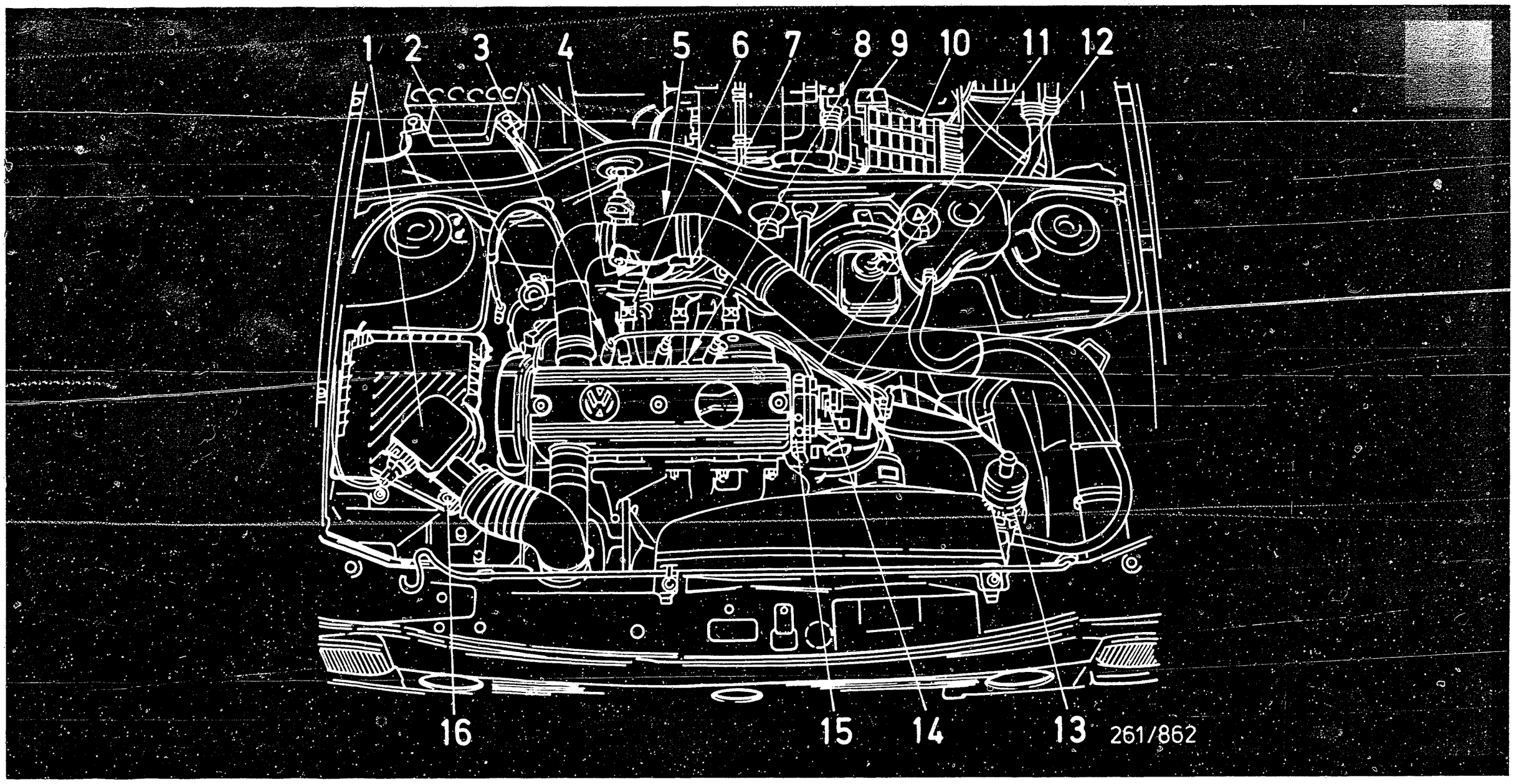
X1= Digifant control-unit plug
Y1= Solenoid-operated injection valves
Y2= Pre-supply pump with sensor (in tank) for fuel gauge
Y3= Electric fuel pump

DIGIFANT ELECTRICAL TERMINAL DIAGRAM



B4= Temperature sensor (engine)
F1= Pump fuse (No. 1)
F2= Main-relay fuse
K1= Pump relay
K2= Main relay
S1= Idle switch
S2= Full-load switch
T1= Ignition coil
X1= Digifant control-unit plug

DIGIFANT ELECTRICAL TERMINAL DIAGRAM (CONTINUED)



1= Air-flow sensor
2= Pressure regulator
3= Knock sensor
4= Idle switch
5= Idle-speed adjusting screw
6= Injection valve
7= Full-load switch
8= Auxiliary-air device
9= Main and fuel pump relay
10= Digifant control unit
11= 2-pole plug connection to auxiliary-air device
12= 3-pole connection to knock sensor
13= Ignition coil
14= Plug to magnetic pulse generator
15= Temperature sensor (engine)
16= CO adjusting screw

INSTALLATION POSITION OF COMPONENTS

C19 — ⟹

C20 — ⟺

INSTALLATION POSITION OF COMPONENTS (CONTINUED)

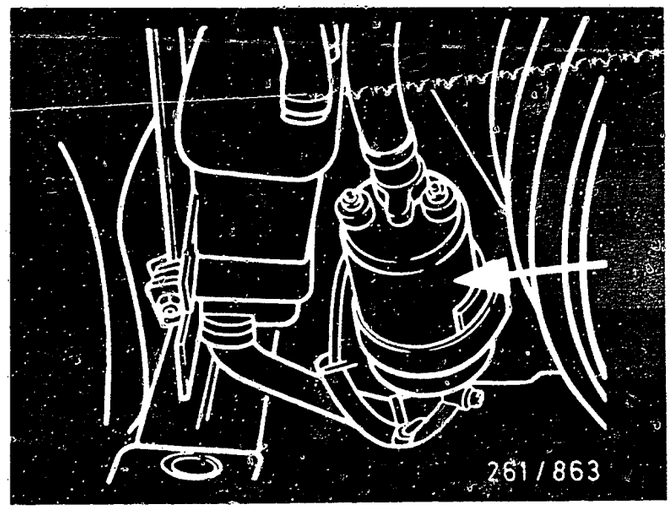
The installation locations always refer to the direction of travel.

Pump fuse:
In fuse box (pump fuse No. 1).

Fuel pump and fuel filter:
Beneath vehicle, in vicinity of fuel tank.
See top picture.

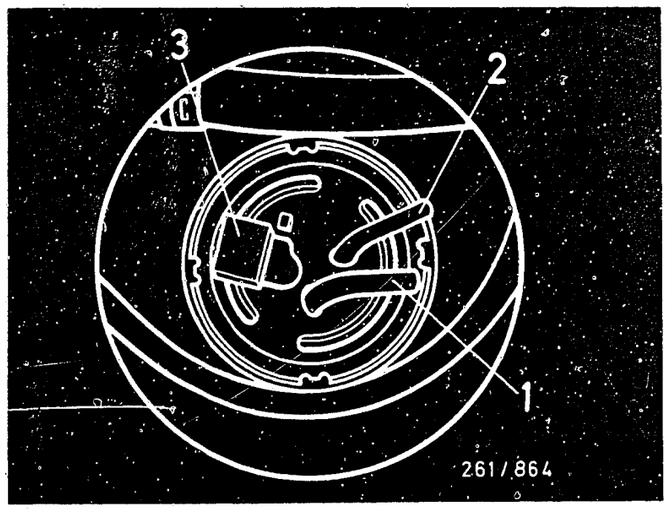
Pre-supply pump:
In fuel tank (bottom picture).

Temperature sensor (intake air):
Integrated into air-flow sensor.



Arrow = Electric fuel pump

Installation position of pre-supply pump
1 = Supply line (delivery measurement, pre-supply pump)
2 = Fuel return connection
3 = Electrical connection for pre-supply pump (center and outer brown lead) and fuel indicator



Trouble-shooting instructions	:	OPE-5017
BOSCH system	:	EI
Make of vehicle	:	OPEL
Basic microcard	:	PKW- 122

TABLE OF CONTENTS

SPECIAL FEATURES

These brief instructions, valid at the time of publication, apply to the following Opel model:

Corsa-A GSi with 1.6 l/ 4-cyl. engine
E 16 SE 3.88 ->.

* Spark-advance unit 0 227 921 053

* Ignition coil with trigger box 0 221 600 053 (with current limitation)

STRUCTURE AND USAGE

These brief instructions encompass essentially vehicle-specific special features and test specifications (set values).

In accordance with the customer complaint, the trouble-shooting chart leads to different causes/component faults.
For a detailed description of trouble-shooting, see the information in the trouble-shooting chart of the basic instructions.

ATTENTION: Even if reference is made to basic instructions, the set values, terminal assignments and special features of these vehicle-related brief instructions are always binding.

SAFETY AND PRECAUTIONARY MEASURES

In order to keep persons out of danger and to avoid damage to the engine, trigger boxes and control units or to the ignition system, observe the information in the basic instructions.

CAUTION!
High-performance ignition system with dangerous primary and secondary voltages!

Touching voltage-carrying components or terminals may prove fatal (both on the primary and secondary sides).

TROUBLE-SHOOTING CHART

Customer complaint (fault symptoms)

1. Starting motor operates, engine fails to start or starts only with difficulty.	2. Engine starts but then dies.	3. Idle problems (engine speed, exhaust gas).	4. Poor throttle take-up, flat spot during acceleration.	5. Engine missing (ignition, injection).	6. Maximum engine power/top speed not reached.	7. Fuel consumption too high.	8. Engine running on (dieseling).	9. Engine pinging/knocking.	10. Engine overheating.	11. Fault lamp.	Cause (component fault)
*				*							High-tension side
*											Firing sequence
*				*							Ignition coil
*											Ignition-distributor assembly setting
*											Trigger-box voltage
*											Primary circuit
*											Spark-advance-unit voltage
*											Ignition-distributor plug and socket
*											Magnetic-pulse-generator voltage
*											Magnetic-pulse-generator function
*											Spark-advance-unit function
*											Contact resistance (primary side)
*											Engine-speed signal
*											Primary signal
*		*	*		*	*		*	*		Basic ignition setting
					*	*					Characteristic-curve control lead
					*	*					Temperature switch (oil)
					*	*					Temp. switch (intake manifold)

TROUBLE-SHOOTING CHART (CONTINUED)

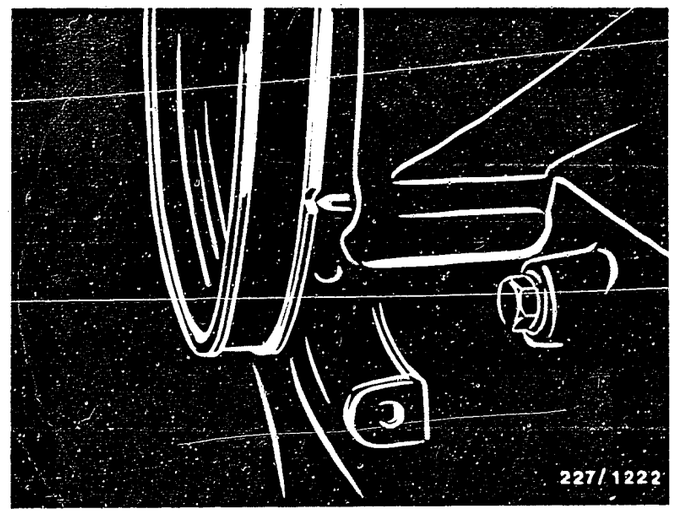
Customer complaint (fault symptoms)

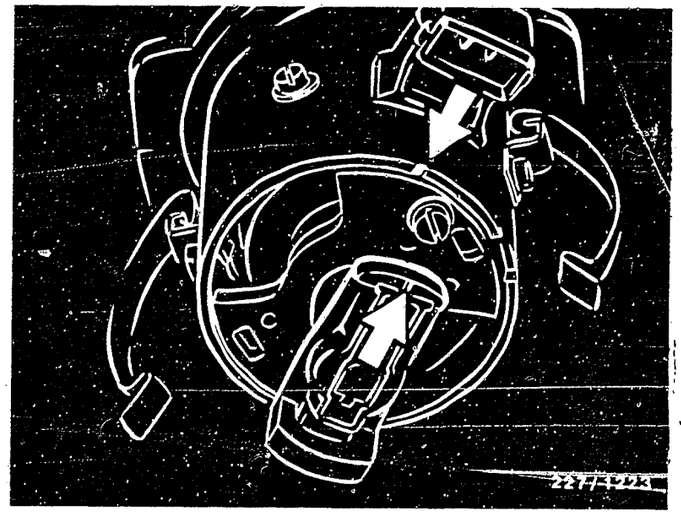
1. Starting motor operates, engine fails to start or starts only with difficulty.	2. Engine starts but then dies.	3. Idle problems (engine speed, exhaust gas).	4. Poor throttle take-up, flat spot during acceleration.	5. Engine missing (ignition, injection).	6. Maximum engine power/top speed not reached.	7. Fuel consumption too high.	8. Engine running on (dieseling).	9. Engine pinging/knocking.	10. Engine overheating.	11. Fault lamp.	Cause (component fault)
*	*		*	*							Throttle-valve switch (idle)
			*	*							Throttle-valve switch (full load)
			*	*							Load signal
							*				RON correction
			*								Trigger-box voltage (engine idling)
			*								Ignition-coil voltage (engine idling)

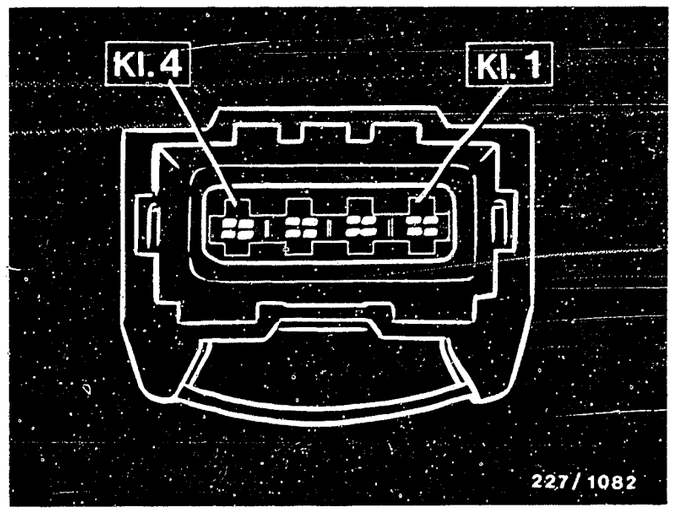
For production reasons: continued on the following coordinate.

RAPID DIAGNOSIS CHART

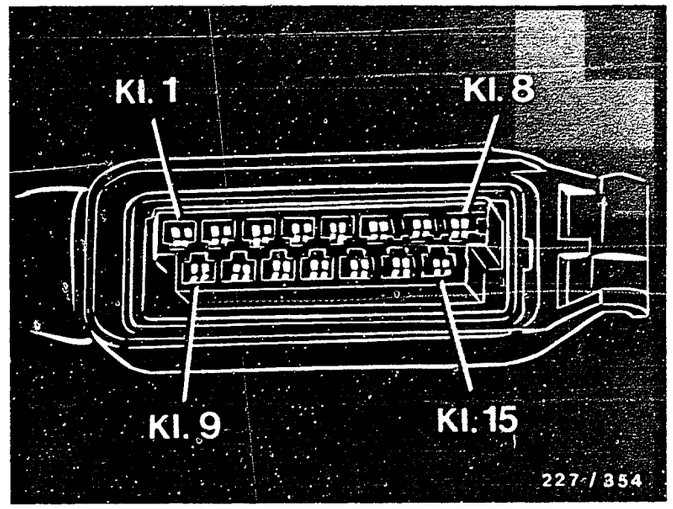
Test step	Testing of component/function Test instructions/conditions	Terminals	Set values
1	HIGH-TENSION SIDE Test function of, for example, spark plugs, ignition harness and distributor cap (e.g. open-circuit, shunt). Access for example by way of ignition oscillogram, resistance measurement, visual inspection.	——	——
2	IGNITION COIL Visual inspection: Plug fitted, sealing compound leaked? Primary resistance Secondary resistance	 1 15 1 4	 0.6... 1.0 Ω 6.4...11.1 k Ω
3	IGNITION-DISTRIBUTOR ASSEMBLY SETTING Engine cyl. no. 1 on pulley mark (10° BTDC) See top picture, arrow. Center of distributor-rotor-electrode faces mark on housing. See center picture, arrow.	——	——
4	TRIGGER-BOX VOLTAGE Detach trigger-box plug. See bottom picture. Ignition ON. Trigger-box-plug voltage.	3 2 (+) (−)	Battery voltage
5	PRIMARY CIRCUIT Trigger-box plug detached. See bottom picture. Trigger-box resistance	 1 3	 approx. 1 Ω (continuity)

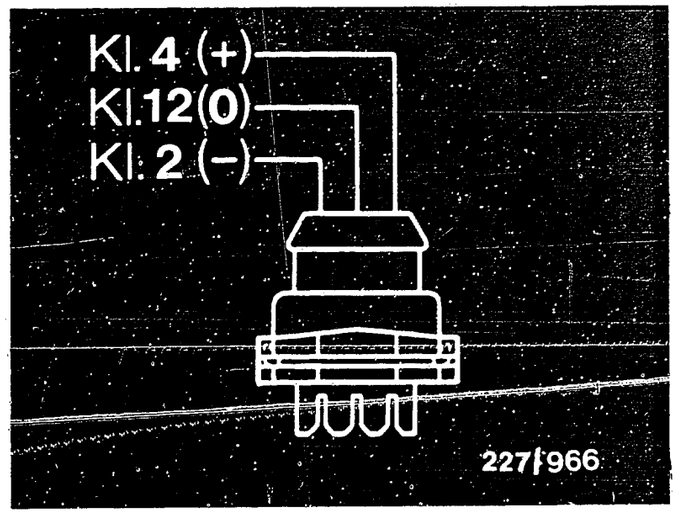


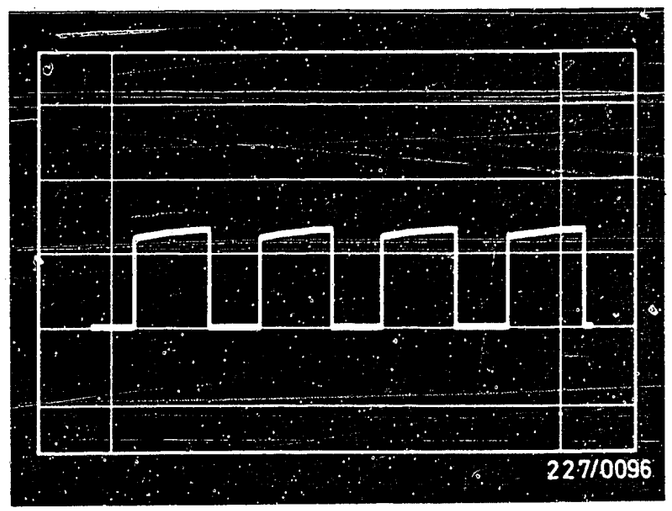




Test step	Testing of component/function Test instructions/conditions	Terminals	Set values
6	SPARK-ADVANCE-UNIT VOLTAGE Detach spark-advance-unit plug. See top picture. Ignition ON. Spark-advance-unit-plug voltage	3 (+) 1 (-)	Battery voltage
7	IGNITION-DISTRIBUTOR PLUG AND SOCKET Detach ignition-distributor plug. Visual inspection: Check ignition-distributor plug and socket for oxidation.	——	——
8	MAGNETIC-PULSE-GENERATOR VOLTAGE Attach ignition-distributor and spark-advance-unit plug. Push back rubber sleeve of ign.-distr. plug. Ignition ON. Ignition-distributor-plug voltage. See center picture	4 (+) 2 (-)	equal to/ greater than 10 V
9	MAGNETIC-PULSE-GENERATOR FUNCTION Oscilloscope "special" to ignition-distributor plug and vehicle ground. Start engine.	12 (+) B- (-)	Rectangular pulse (bottom picture)
10	SPARK-ADVANCE-UNIT FUNCTION Attach trigger-box plug and push back rubber sleeve. Oscilloscope "special" to trigger-box plug and vehicle ground. Continued on next picture page.	4 (+) B- (-)	

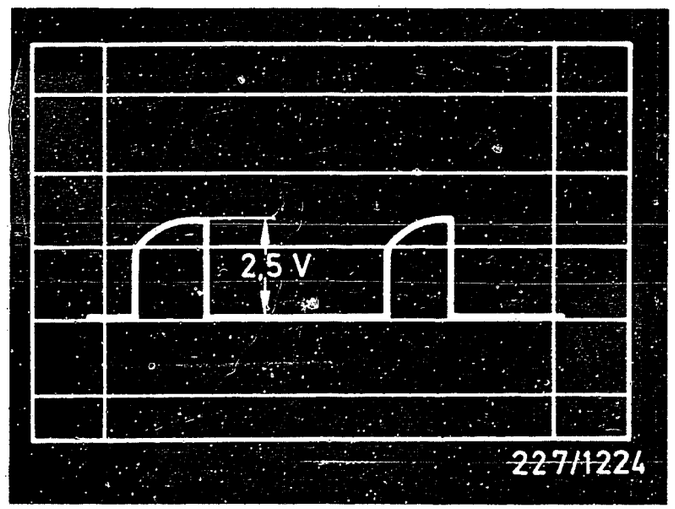


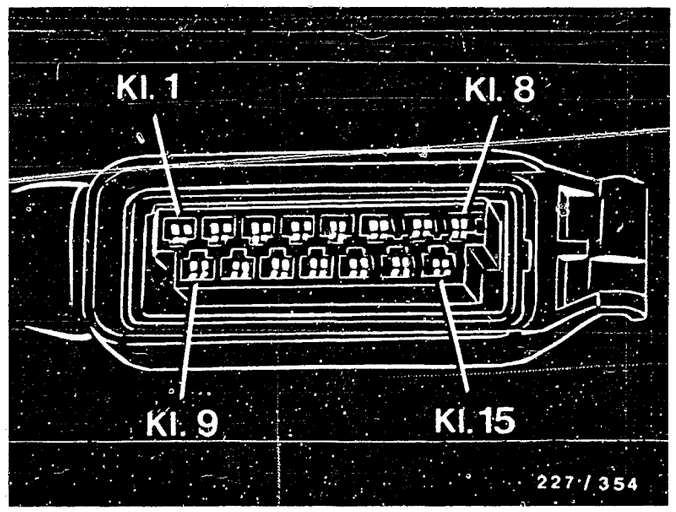


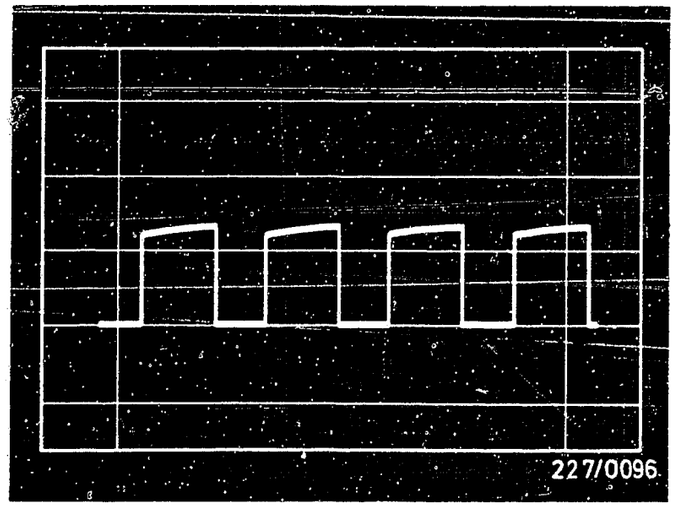


RAPID DIAGNOSIS CHART (CONTINUED)

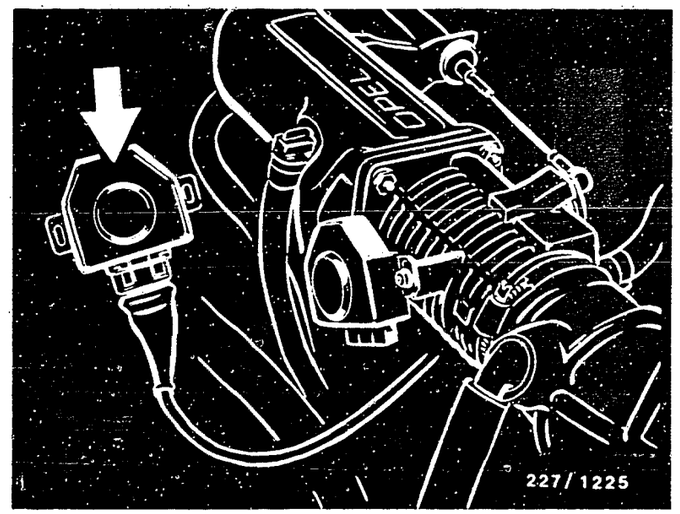
Test step	Testing of component/function Test instructions/conditions	Term-inals	Set values
10	SPARK-ADVANCE-UNIT FUNCTION (Continued) Start engine. * Note: The important factor is the minimum voltage and not the profile (edges may be smooth).	——	* Rectangular pulse equal to/greater than 2.5 V (Top picture)
11	CONTACT RESISTANCE (PRIMARY SIDE) Disconnect neg. and pos. leads from battery. Detach trigger-box plugs. Ignition ON. Resistance from battery terminal to trigger-box plug.	B+ 3 B- 2	max. 0.3 Ω
12	ENGINE-SPEED SIGNAL Connect negative and positive lead to battery. Attach trigger-box plug. Detach LE-Jetronic control-unit plug. See center picture. Oscilloscope "special" to LE-Jetronic control-unit plug and vehicle ground. Start engine.	1 B- (+) (-)	Rectangular pulse (bottom picture)
12	PRIMARY SIGNAL Attach LE-Jetronic control-unit plug. Oscilloscope/engine-speed tester to ignition coil. Start engine.	15 1 (+) (-)	Primary voltage/ engine-speed reading (magnitude irrelevant)

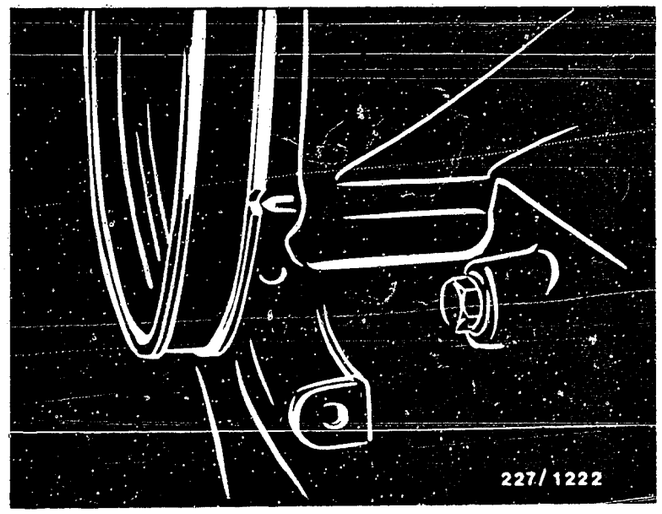


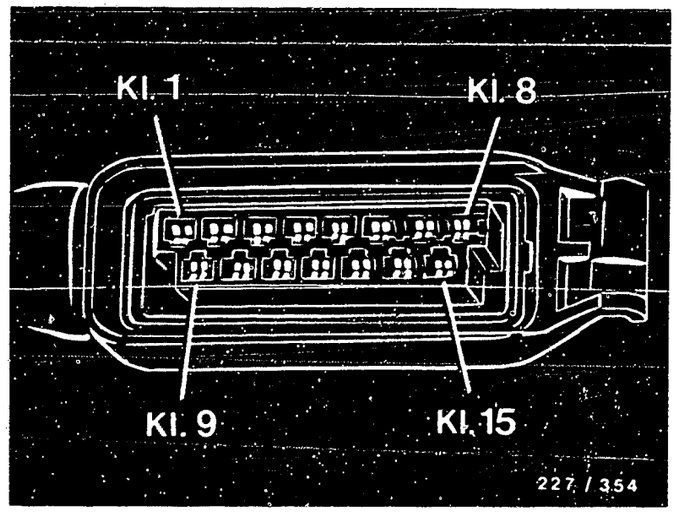




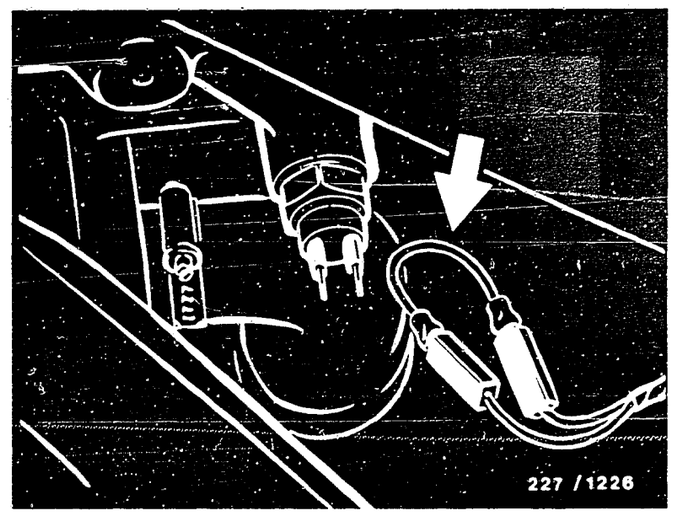
Test step	Testing of component/function Test instructions/conditions	Term–inals	Set values
13	BASIC IGNITION SETTING Eng. at op. temp. (oil temp. approx. + 80° C). Loads OFF. Ignition OFF. Connect Motortester as per operating instruct. Detach throttle–valve–switch plug and connect KDZS 0003 to plug. See top picture, arrow. Engine idling. Read off ignition angle/flash lamp at ignition marks (mark corresponds to 10° BTDC). See center picture, arrow.	——	10° ± 2° v. OT
14	CHARACTERISTIC–CURVE CONTROL LEAD Detach plug from temperature switch (oil) and temperature switch (intake manifold) and jumper both plugs in each case with auxiliary lead. Detach spark–advance–unit plug. See bottom picture. Ignition ON. Spark–advance–unit–plug voltage.	3 (+) 7 (–)	Battery voltage
15	TEMPERATURE SWITCH (OIL) Temperature–switch plug detached. Temperature–switch resistance.	——	Less than approx. +65 °C approx. 0 Ω (continuity) Greater than approx. +65 ° infinity Ω (open–circuit)

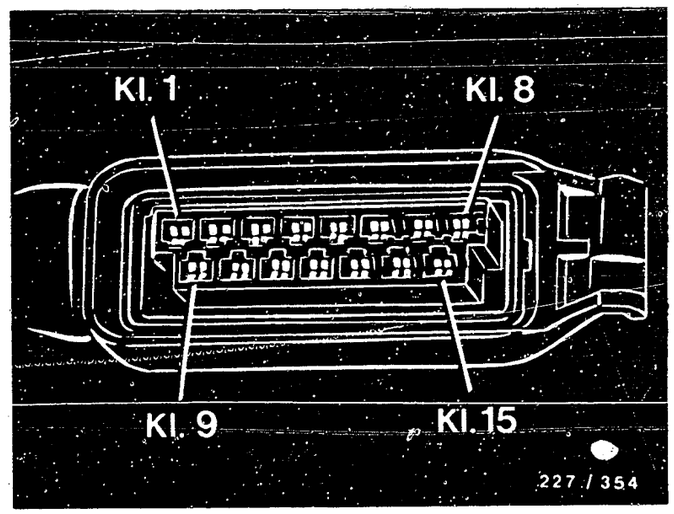


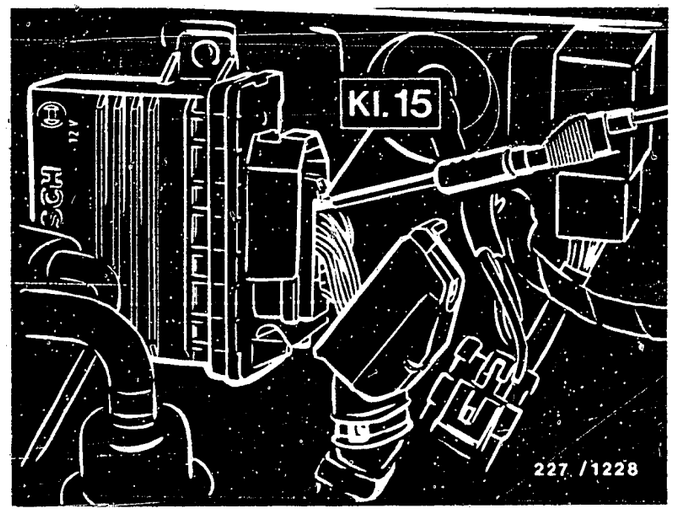




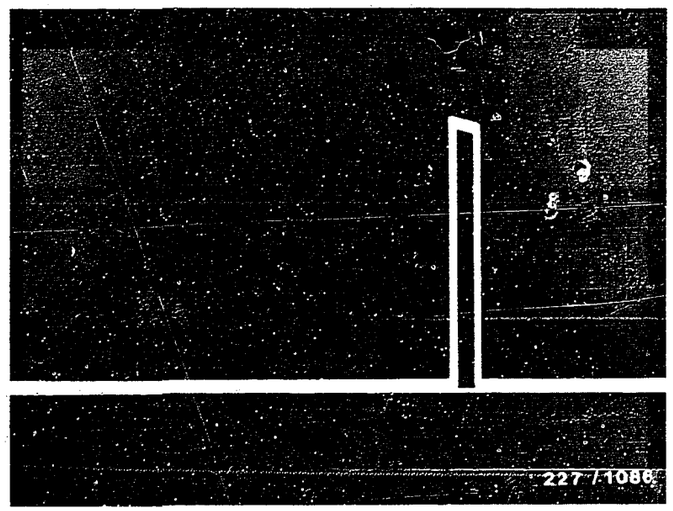
Test step	Testing of component/function Test instructions/conditions	Term-inals	Set values
16	TEMPERATURE SWITCH (INTAKE MANIFOLD) Temperature-switch plug (intake manifold) detached. Temperature-switch resistance. See top picture, arrow.	———	Greater than approx. +17 °C Approx. 0 Ω (continuity) Less than approx. +17 °C infinity Ω (open-circuit)
17	THROTTLE-VALVE SWITCH (IDLE) Detach LE-Jetronic control unit plug. Spark-advance-unit plug detached. Fully depress accelerator pedal. Spark-advance-unit-plug resistance. See center picture. Throttle valve approx. 1 ... 2°	6 1	Approx. 0 Ω (continuity) infinity Ω (open-circuit)
18	THROTTLE-VALVE SWITCH (FULL LOAD) LE-Jetronic control-unit plug detached. Spark-advance-unit plug detached. Fully depress accelerator pedal. Spark-advance-unit-plug resistance. See center picture. Release accelerator pedal (idle position).	14 1	Approx. 0 Ω (continuity) infinity Ω (open-circuit)
19	LOAD SIGNAL Attach LE-Jetronic control-unit plug. Attach spark-advance-unit plug with handle cover removed. See bottom picture. Oscilloscope "special" to spark-advance-unit plug and vehicle ground. Continued on next picture page	15 B- (+) (-)	———

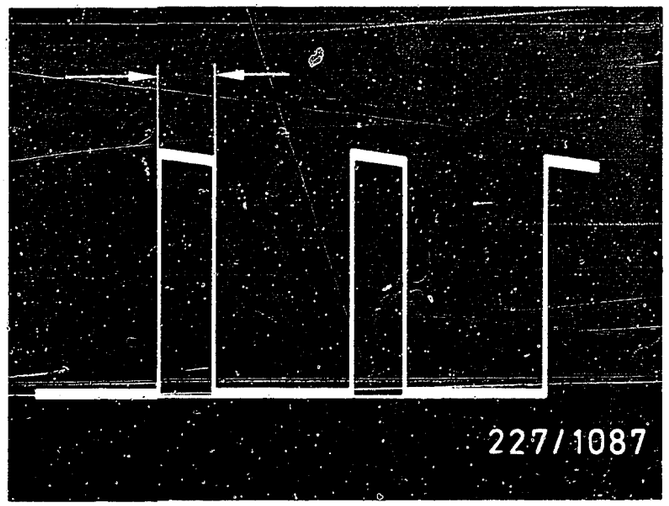


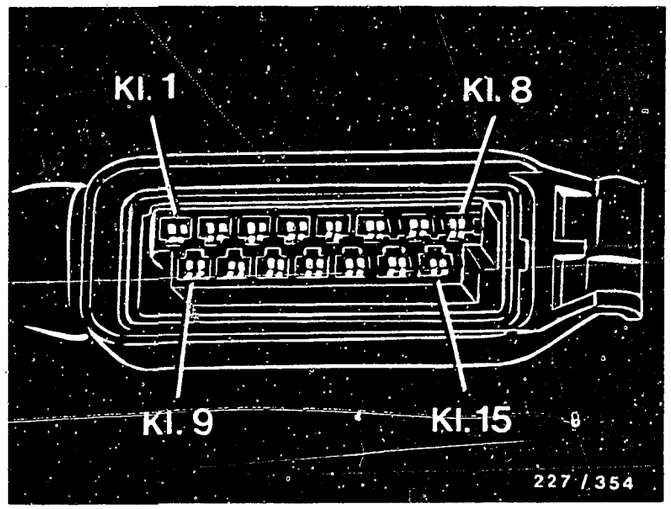




Test step	Testing of component/function Test instructions/conditions	Terminals	Set values
19	LOAD SIGNAL (continued) O R Connect dwell-angle tester to battery and spark-advance-unit plug. Allow engine to idle. Load signal must be present or read off and note down dwell-angle value. Briefly accelerate to full throttle and observe load signal/dwell-angle indication. There must be a clear alteration in the pulse duration of the load signal/dwell-angle value	 B+ 15 (+) (–) —— ——	 —— Load signal (top picture) Load signal (center picture, arrow)
20	RON CORRECTION LEAD Detach spark-advance-unit plug. Ignition ON. Spark-advance-unit-plug voltage. See bottom picture.	 3 8 (+) (–)	 Battery voltage
21	TRIGGER-BOX VOLTAGE Attach spark-advance-unit plug. Push back rubber sleeve of trigger-box plug. Trigger-box-plug voltage. Engine idling.	 3 2 (+) (–)	 12 – 14 V max. 1 V below U_B
22	IGNITION-COIL VOLTAGE Voltage at ignition coil and battery. Engine idling.	 15 B– (+) (–)	 equal to/greater than 10 V







TEST SPECIFICATIONS

Ignition coil, primary	0.6...1.0 Ω
Ignition coil, secondary	6.4...11.1 k Ω
Ignition distributor assembly setting	Cyl. no. 1 10° BTDC ID-mark
Trigger-box voltage on ignition	Battery voltage
Primary circuit	Approx. 1 Ω (continuity)
Spark-advance-unit voltage with ignition ON	Battery voltage
Magnetic-pulse generator with ignition ON	equal to/greater than 10 V
Magnetic-pulse-generator function at cranking speed	Rectangular pulse
Spark-advance-unit function at cranking speed	Rectangular pulse at least 2.5 V
Contact resistance supply leads trigger box	max. 0.3 Ω
Engine-speed signal at cranking speed	Rectangular pulse
Primary signal at cranking speed	Primary voltage/ engine-speed indication
Basic ignition setting Engine-oil temp. approx.+ 80° C Throttle-valve-switch plug jumpered with KDZS 0003. Engine idling	10° ± 2° v. OT

TEST SPECIFICATIONS (CONTINUED)

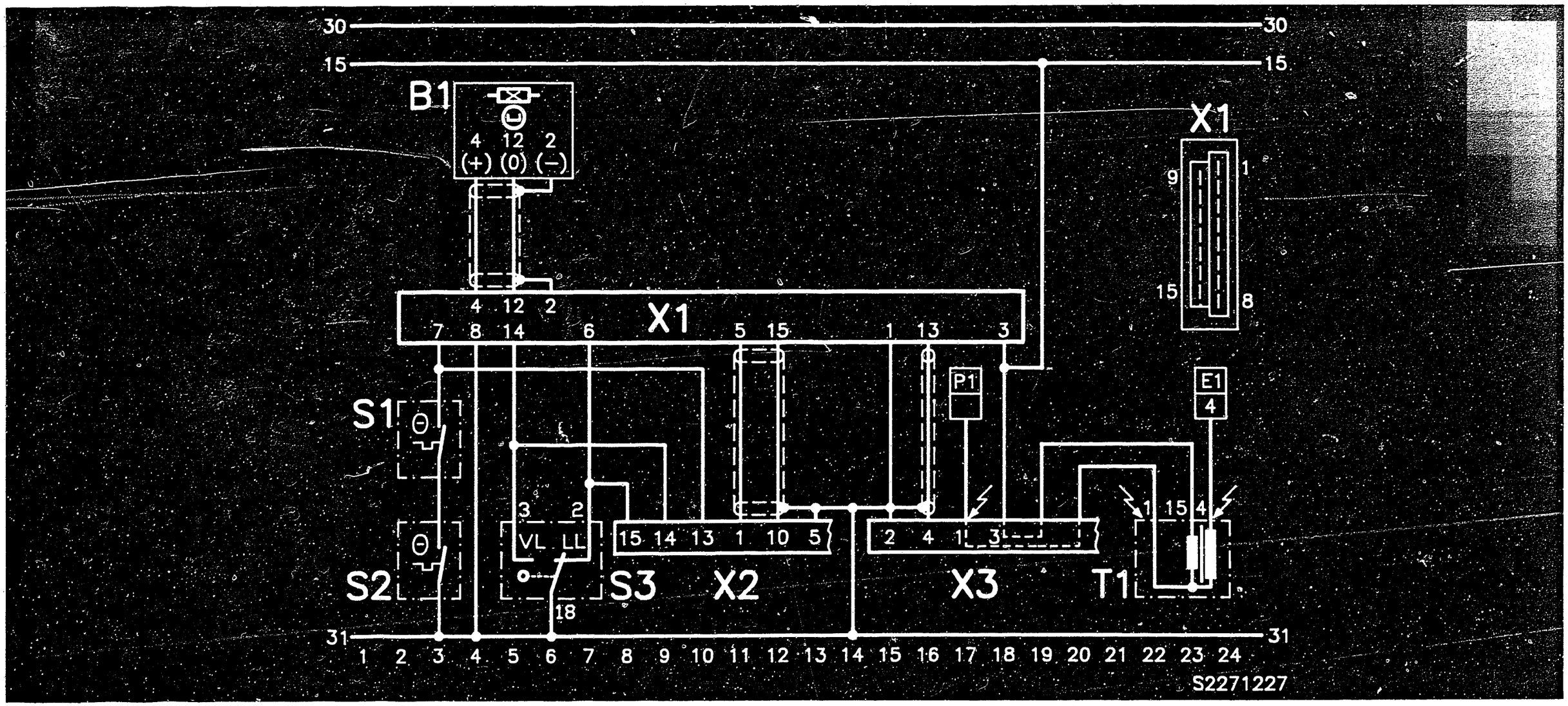
Characteristic-curve control lead with ignition ON	Battery voltage
Temperature sensor (oil)	Less than approx. + 65 °C approx. 0 Ω (continuity) Greater than approx. 65 °C Infinity (open-circuit) Tightening torque 20 Nm
Temperature switch (intake manifold)	Greater than approx. +17 °C Approx. Ω (continuity) Less than approx. +17 °C Infinity Ω (open-circuit) Tightening torque 6 Nm
Throttle-valve switch (idle) Idle position Open throttle valve 1...2°	Approx. 0 Ω (continuity) Infinity Ω (open-circuit)
Throttle valve switch (full load) Full-load position Idle position	Approx. 0 Ω (continuity) Infinity Ω (open-circuit)
Load signal Briefly accelerate to full throttle	Pulse duration must change.
RON correction with ignition ON	Battery voltage

TEST SPECIFICATIONS (CONTINUED)

Trigger-box voltage with engine idling	12...14 V max. 1 V below U_B
Ignition-coil voltage with engine idling	equal to/greater than 10 V

Please refer to SIS Microcard Jetronic or test specifications for settings as regards idle speed, exhaust gas, valve clearance.

For production reasons:
continued on the following coordinate.



High-tension arrows: Caution 400 V...25 kV

B1 = Magnetic pulse generator (ignition distributor)
E1 = to ignition distributor
P1 = Test connection
S1 = Temperature switch (intake manifold)
S2 = Temperature switch (oil)
S3 = Throttle-valve switch
T1 = Ignition coil
X1 = Spark-advance-unit plug
X2 = LE-Jetronic control-unit plug
X3 = Trigger-box plug

ELECTRICAL TERMINAL DIAGRAM

INSTALLATION POSITION OF COMPONENTS

* Sleeve for TDC sensor is located at cylinder block (beneath oil filter).

* Trigger box and ignition coil are mounted on a joint heat sink and are located at the wheel house, front left.

* The spark-advance unit is located at the engine-compartment bulkhead.

* The measurement and control unit (LE-Jetronic) is located at the air filter.

* The throttle-valve switch is located at the throttle-valve assembly.

* The temperature switch (oil) is located at the cylinder block beneath the alternator.

* The temperature switch (intake manifold) is located at the intake manifold.

For production reasons: continued on the following coordinate.

Trouble-shooting instructions : POR-5008

BOSCH system : K-Jetronic with lambda closed-loop control

Make of vehicle : Porsche

Similar detailed instructions : MB 03/J1, AUD 506

TABLE OF CONTENTS

SAFETY AND PRECAUTIONARY MEASURES

Pay attention to general safety precautions for working on engines and Jetronic systems (see basic instructions) for example), so as to avoid injury to people and engine/auxiliary-system damage. Particular reference is made
here to the personal hazards resulting from a heavy-duty ignition system and to the dangers of engine damage when working on the K-Jetronic.

SPECIAL FEATURES

These instructions contain trouble-shooting instructions, valid at the time of publication, for the K-Jetronic in the following vehicle models:

Porsche 911-Turbo, USA model as of 9.85
K-Jetronic with lambda closed-loop control
Engine type designation:
930/68, 3.3 l, 220 kW/299 bhp

Special features of K-Jetronic:

* Fuel distributor in 8-cyl. version, 2 outlets not handled.
* 2 electric fuel pumps, for large delivery and high system pressure.
* Warm-up regulator: version for manifold-pressure full-load enrichment.
* Electronic connection of lambda closed-loop control. Refer to Technical Instruction VDT-U 3/1 En for basic principle.

Special features of lambda closed-loop control (see also electrical terminal diagram):

Program-controlled acceleration enrichment by way of on/off ratio control. Special components for this purpose: additional control unit, 35°C temperature switch, throttle-valve switch with contacts for idle, 7° opening angle and full load.

Function: Enrichment function only with engine temperature below 35° C.
Slow acceleration: increase in on/off ratio to 75% in each case following opening of idle and 7° contact. Duration 2.5 seconds.
Rapid acceleration: once-only enrichment. The enrichment is suppressed after the full-load contact (approx. 66° opening angle) has been overshot.

SPECIAL FEATURES (CONTINUED)

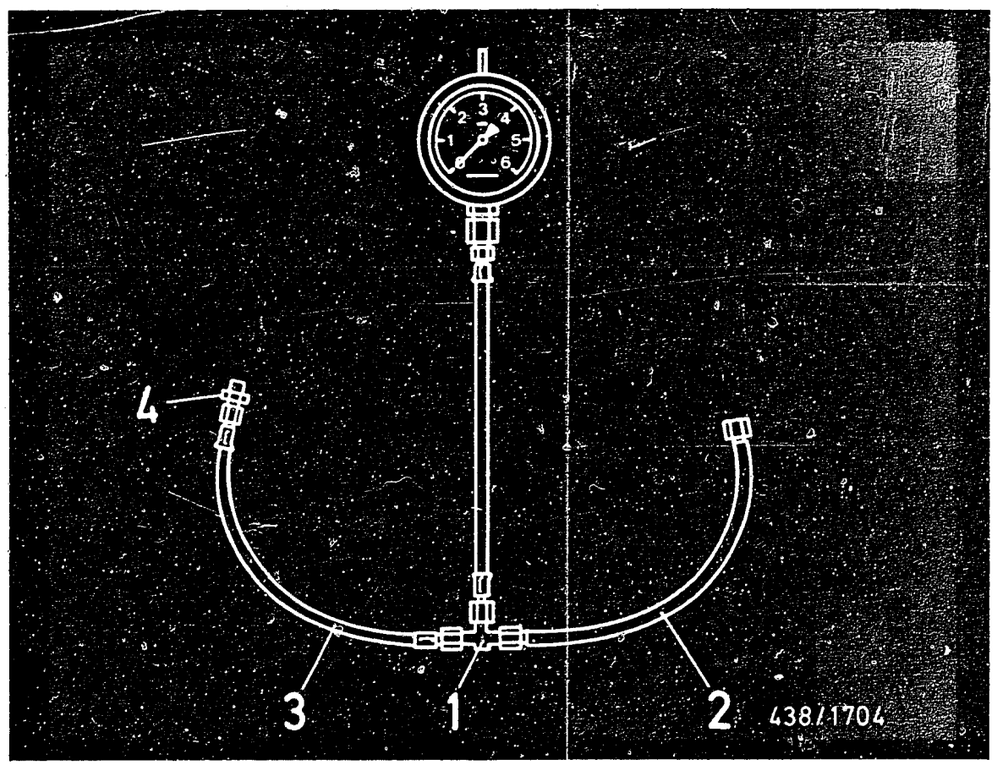
Note: As of 1.86 new control unit for acceleration enrichment: to improve cold starting, the on/off ratio is increased after every start below 35°C to 75 % for 5 seconds. Acceleration enrichment takes effect for 2 minutes after every start (including warm start) and is triggered when the throttle valve opens more than 7°.
The new control unit with Porsche part number 930.617.131.01 (old ...00) can be retrofitted in vehicles with poor throttle take-up.

* Safety circuits: The electric fuel pumps are switched off via 2 safety circuits, so as to protect the engine against overload:
1. In the event of excessive charge-air pressure by means of charge-air-pressure switch 1.1...1.4 bar gauge. If the pressure becomes too great, the switch opens and the pumps are switched off via the control relay.
2. Engine-speed limitation. At 7000 min^{-1} the pumps are switched off by the engine-speed relay and control relay.

Engine equipment:

The engine of the 911 Turbo, which is designed for unleaded premium fuel, is equipped with a 3-way catalytic converter controlled by the lambda system and a secondary air system for exhaust aftertreatment. When the engine is cold, the secondary air is injected behind the exhaust valves; when the engine is at operating temperature, the secondary air is injected at the outlet of the catalytic converter.

When performing trouble-shooting, attention is to be paid to the function of these systems and other additional components in the air system, as well as to their effect on the running behavior of the engine. Refer to schematic and description of auxiliary components as of Coordinate 21/22.

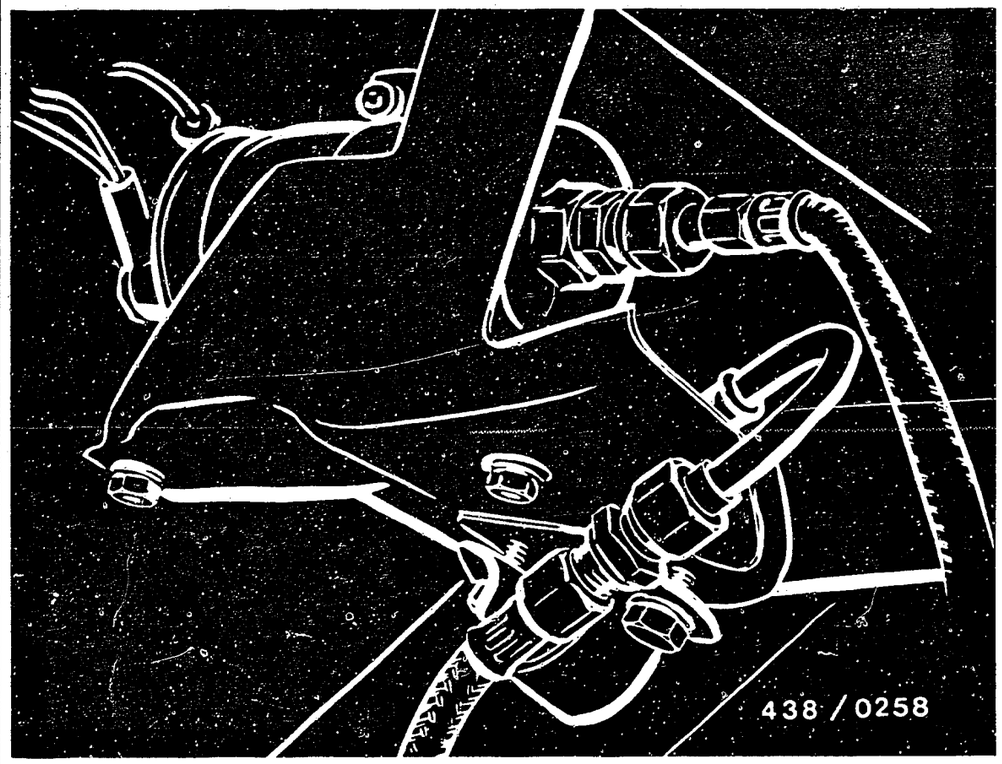


SPECIAL TOOLS, USAGE

The high system pressure (6.0...6.7 bar gauge) means that the version of the pressure measuring device KDJE-P 100 with pressure gauge 0...10 bar is required. Connection for standard pressure measurements is effected with connection parts from the Jetronic case KDJE-K 100.

The pressure measuring device KDJE-P 100 is also required for measuring pressure in the fuel line between the two electric fuel pumps. For this purpose, the device is to be converted as shown in the picture. Parts required:

1 = Commercially available tee union M 12x1.5 (e.g. Ermeto).
2 = Commercially available hose approx. 30 cm, with ball connections M 12x1.5 / M 14x1.5.
3 = Hose from KDJE-P 100 with ball connections M 12x1.5.
4 = Commercially available double threaded connector M 12x1.5/M 14x1.5.

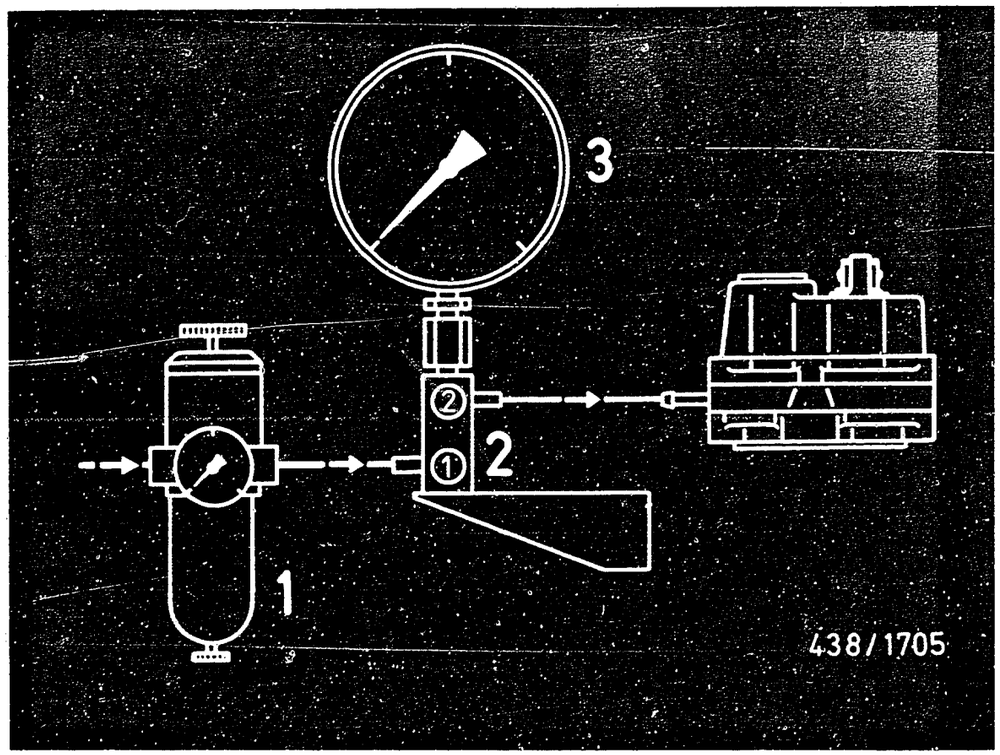


SPECIAL TOOLS, USAGE (CONTINUED)

Pressure measurement is required so as to be able to determine the actually defective pump, if the overall delivery of the two electric fuel pumps is too low. Procedure:

Jack up vehicle and unscrew supply line of electric fuel pump 2 (on bottom of vehicle, in front of left-hand rear wheel). Catch fuel emerging. Connect converted pressure measuring device to unscrewed line and to pump inlet (picture).

Switch on electric fuel pumps. Pressure gauge must indicate a pressure between 2 and 4 bar gauge. If the value is less than 2 bar gauge, electric fuel pump 1 is defective; if the reading is in excess of 4 bar gauge, electric fuel pump 2 is defective.

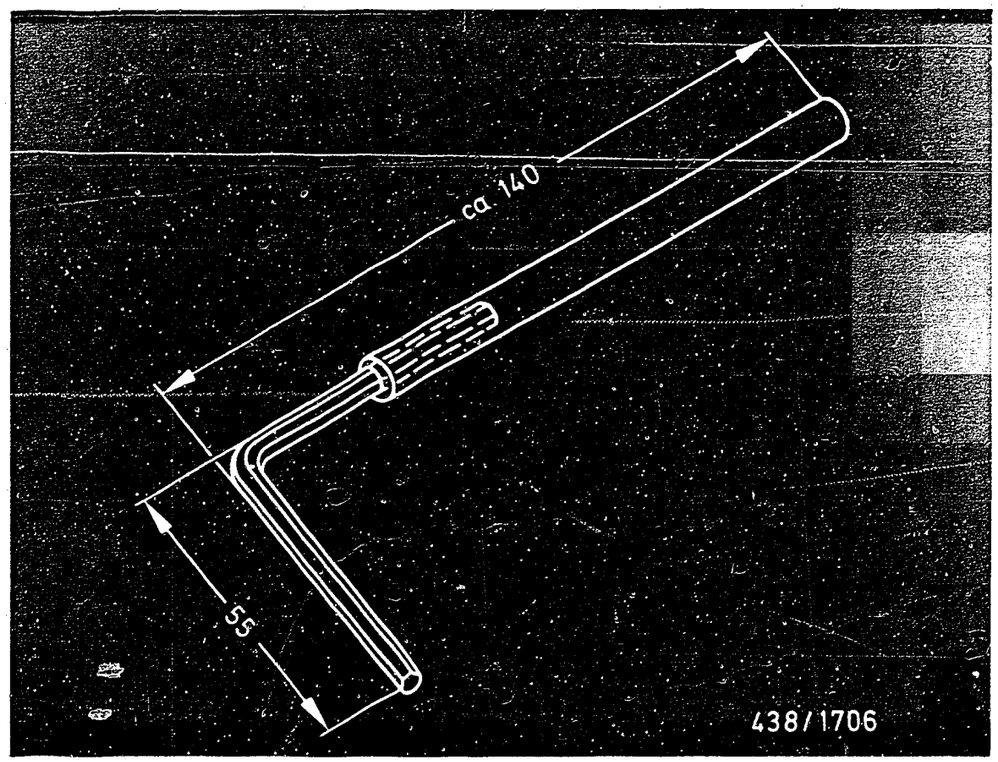


SPECIAL TOOLS, USAGE (CONTINUED)

Air pressure corresponding to charge-air pressure must be applied to the warm-up regulator for testing the full-load control pressure on warm-up regulators for manifold-pressure full-load enrichment. Apply pressure from workshop compressed-air network using suitable precision adjuster. The device indicated as an example in the picture is often already available in workshops:

1 = Commercially available pressure regulator with pressure gauge 0...4 bar gauge.
2 = Bosch adjusting throttle 0 688 130 132.
3 = Commercially available pressure gauge 0...1.6 bar gauge, quality class 1.0 (e.g. Wika No. 4184).

Connection to warm-up regulator as indicated in picture. For applying pressure, set pressure regulator to approx. 1 bar gauge. Adjustment of test pressure in accordance with test specifications at valves 1 and 2 of adjusting throttle.



SPECIAL TOOLS, USAGE (CONTINUED)

Important note concerning above-described testing of full-load control pressure:

The maximum permissible test air pressure for the warm-up regulator is 1.5 bar gauge. At higher pressures there is a danger of the full-load diaphragm of the warm-up regulator being destroyed or pre-damaged.

Testing of the full-load control pressure should be included in all trouble-shooting measures. As a final step, firmly attach air pressure hose to warm-up regulator. Extremely serious engine damage may result from an undetected fault in the warm-up regulator or from a loose hose.

Adjustment of the idle-mixture-adjusting screw necessitates the use of an extra-long wrench for 3 mm hexagon-socket-head cap screw. Wrench is commercially available or can be user-produced in line with the dimensions given in the picture above.

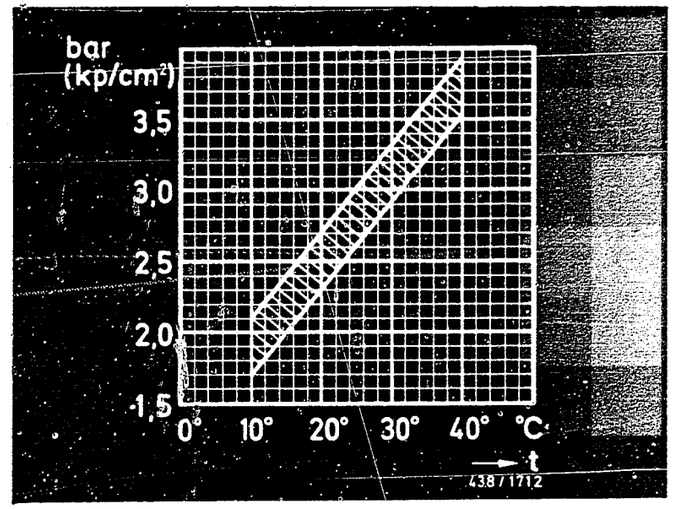
TROUBLE-SHOOTING CHART

Customer complaint (fault symptoms)

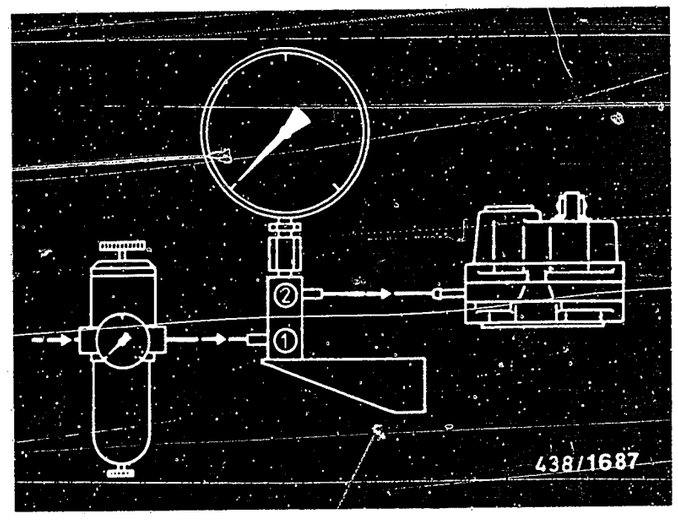
1. Starting motor operates, engine fails to start or starts only with difficulty.	2. Engine starts but then dies.	3. Idle problems (engine speed, exhaust gas).	4. Poor throttle take-up, flat spot during acceleration.	5. Engine missing (ignition, injection).	6. Maximum engine power/top speed not reached.	7. Fuel consumption too high.	8. Engine running on (dieseling).	9. Engine pinging/knocking.	10. Engine overheating.	Cause (component fault)
*	*			*	*					Electric fuel pump(s), delivery
*	*	*	*		*					Induction system
*	*		*				*			Fuel distributor (mechanical)
						*				Fuel distributor (min. delivery)
*		*	*	*	*	*			*	Fuel distributor (delivery scatter)
*	*				*		*			Air-flow sensor (mechanical)
*							*			Air-flow sensor (position of sensor plate)
*	*	*				*	*			Cold-start system
*	*	*		*	*		*			Injection valves
*	*						*			System pressure
*	*	*	*		*	*	*		*	Control pressure
		*			*					Throttle-valve assembly/throttle valve
		*								Auxiliary-air device
		*	*		*				*	Lambda closed-loop control
*	*	*								Idle-speed adjustment
*	*	*			*					Auxiliary air systems
*		*		*				*		Ignition system
*	*	*		*	*	*		*	*	Engine fault

TEST SPECIFICATIONS

No.	Test/test condition	Set value
1	Electric fuel pumps Total delivery of both pumps: Delivery pressure in line between both pumps: Supply voltage under load (both pumps):	 min. 1500 cm ^{3} /30 s 2...4 bar min. 11.5 V
2	Delivery – control pressure circuit:	160...240 cm ^{3} /min
3	Fuel distributor – system pressure: test specific.: setting:	6.0...6.7 bar 6.2...6.5 bar
4	Control pressure tests: Part No. of warm-up regulator: 0 438 140 153 – version for manifold-pressure full-load enrichment. Take control-pressure set value "cold" in accordance with measured ambient temperature from adjacent diagram. No pressure applied to warm-up regulator for testing. Control pressure "warm": for testing "with charge-air pressure", pressure application requires a special test facility as described on Coordinate 6. Pressure setting at adjusting throttle: open valve 2, set pressure value with valve 1 (bottom picture). Test specifications: without charge-air pressure: with charge-air pressure 400...600 mbar gauge: Pneumatic leak test on full-load diaphragm: Maximum drop in pressure as of setting:	 3.75...4.15 bar 2.7...3.1 bar 100 mbar/15 s



p = Control pressure (gauge pressure)
t = Ambient temperature



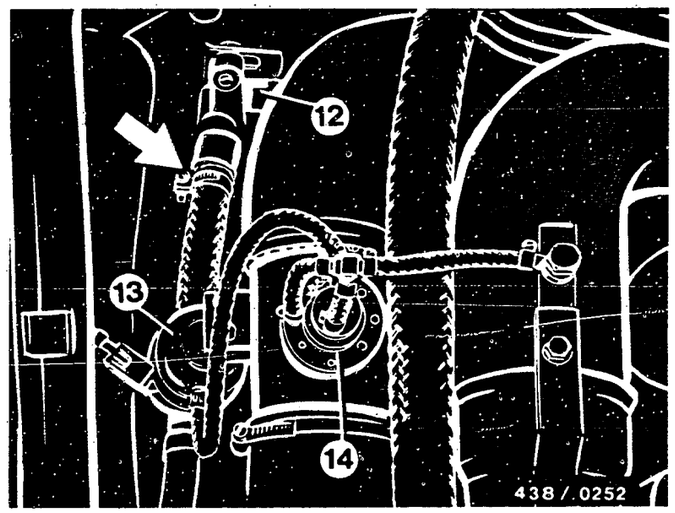
TEST SPECIFICATIONS (CONTINUED)

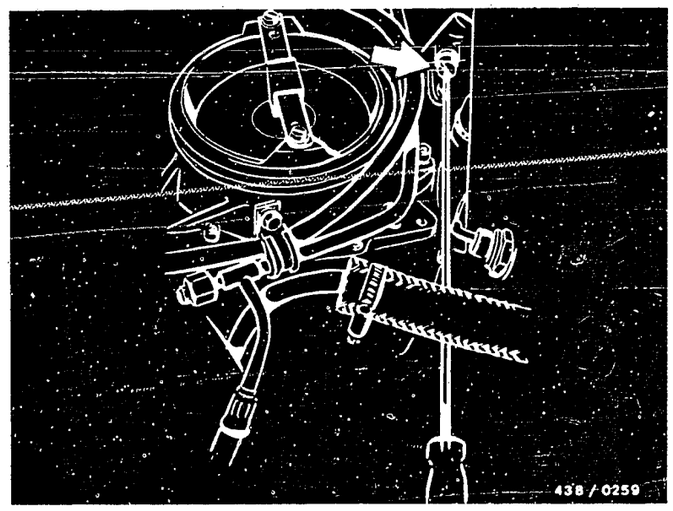
No.	Test/test condition	Set value	
5	Leak test – overall fuel system: Minimum pressure after 10 min.: Minimum pressure after 20 min.:	 1.7 bar 1.5 bar	
6	Injection valves – opening pressure: Leak test at pressure: Time within which no droplet may drip off:	2.1...3.2 bar 1.9 bar 25 s	
7	Fuel distributor; delivery reference measurement: Idle: Part load Full load Minimum delivery with max. sensor-plate deflection:	Setting: (cm^3/min) 6.0 40.0 160.0 Maximum reading of measuring instrument	Max. perm. delivery: (cm^3/min) 6.8 44.0 176.0
8	Thermo-time switch – resistance measurement between: Terminal G and ground: Terminal W and ground: Terminal G and terminal W:	 Below + 40° C 30...40 Ω 0 Ω 30...40 Ω	 Above + 50° C 55... 85 Ω 120...160 Ω 55... 85 Ω
9	Auxiliary-air device – resistance value:	10...45 Ω	
10	Idle-speed adjustment (pay attention to special notes, next Coordinate): * Idle speed: * CO content in exhaust gas (lambda sensor not connected): * Mean value of on/off ratio (sensor connected):	 850 ... 950 min^{-1} 0.4 ... 0.8 VOL. % 0.45 ... 0.55 %	

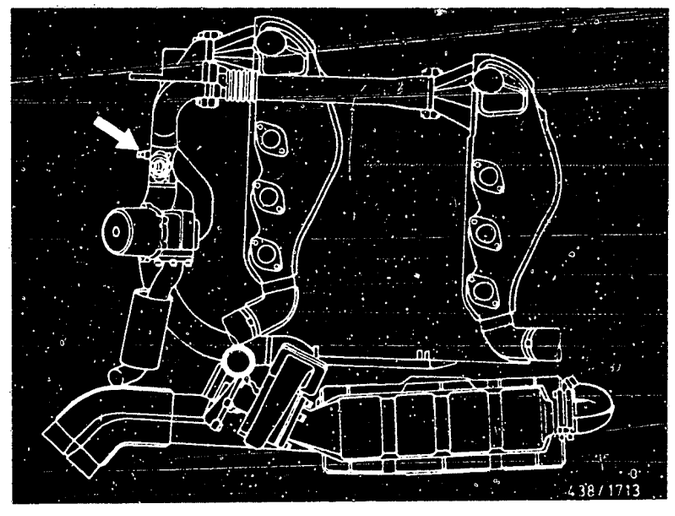
TEST SPECIFICATIONS (CONTINUED)

Special notes on idle-speed adjustment (must be adhered to):

* Engine, ignition and turbo system O.K. No leaks in exhaust system.
* Engine at operating temperature (80...90° C), loads switched off.
* Testing and adjustment always with fitted charge-air cooler and air filter.
* Detach hose from secondary air pump to engine and seal it tightly with suitable plug (arrow, top picture).
* Perform testing and adjustment work as quickly as possible, so as to avoid overheating the intake ducts.
* Bypass screw for idle speed: see arrow, center picture.
* Prior to CO measurement, disconnect plug connection of lambda sensor (triple plug connection in area of control panel on left of engine compartment).
* Perform CO measurement ahead of catalytic converter at special sampling connection in exhaust pipe (see arrow, bottom picture). To do so, unscrew screw plug of connection. Screw in suitable tailpiece for exhaust-gas hose of exhaust-gas analyzer (possibly user-produced with commercially available screw plug). As a final measure, coat screw plug with Bosch assembly paste VS 14 016 Ft (for lambda sensors) and screw it in.
* If the CO value has to be corrected, the following is to be observed:
  + Connect on/off-ratio measuring instrument (lambda closed-loop control tester) to pin A of diagnosis pin terminal. This is located in the control panel (left-hand side of engine compartment) to the left of the ignition trigger box.
  + The spring-mounted pin wrench for CO adjustment mounted at the mixture control unit is sealed with a bonded-in aluminium plug. The complete pin wrench is thus to be replaced and secured by bonding in a new plug using for example Loctite 270 following CO adjustment. Porsche part number of plug: 930 110 921 00. For replacement of the pin wrench, the complete mixture control unit is to be removed.
  + Always perform CO adjustment from rich to lean side, i.e. in the event of too rich a value initially turn adjusting screw more than necessary in a counter-clockwise direction and then turn it in a clockwise direction until the setting is reached.
  + Following CO adjustment, connect lambda sensor and measure on/off ratio. The reading must fluctuate (closed-loop operation); the average value should be approx. 0.45...0.55 %. In the event of an excessive deviation, the likely cause is a leak in the exhaust system between engine and catalytic converter.







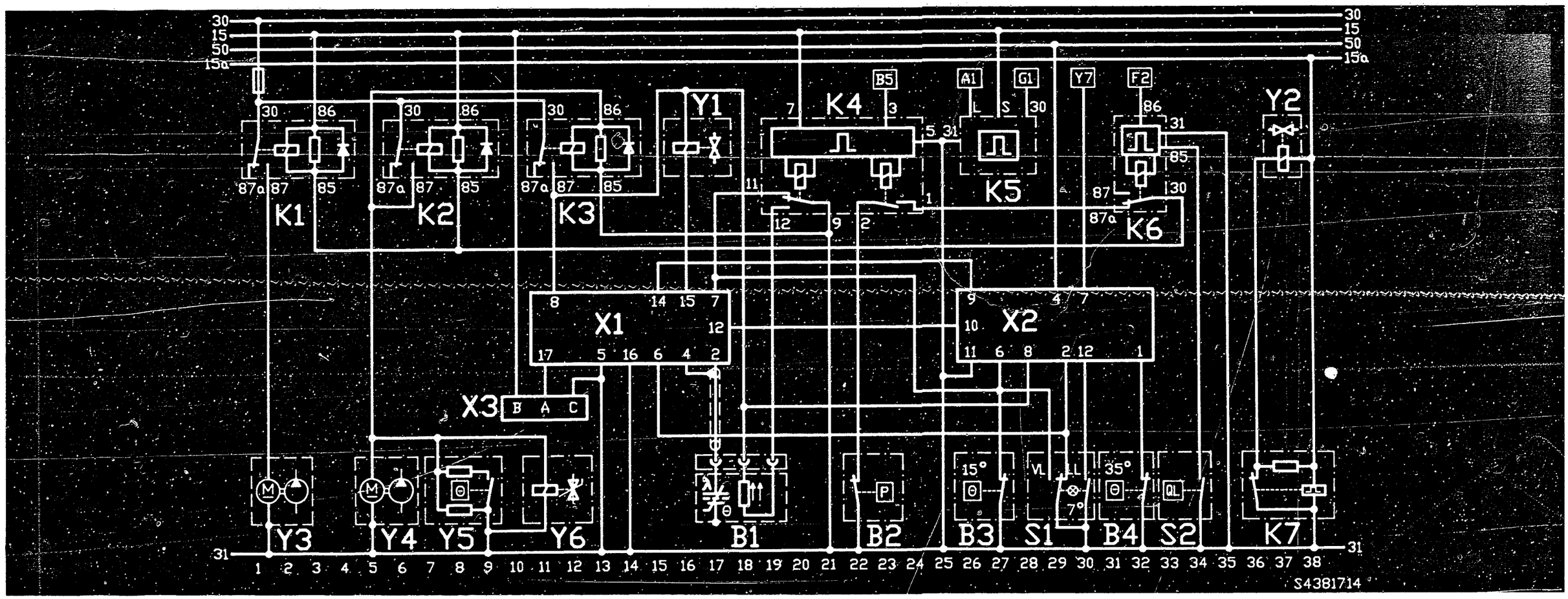
RAPID DIAGNOSIS CHART FOR LAMBDA CLOSED-LOOP CONTROL

Note: Adhere to test sequence. Pay attention to electrical circuit diagram.

No.	Testing of component/function	Test instructions, test conditions	Set values	Possible cause of fault
1	Test preparations	Warm up engine and switch it off again. Connect lambda closed-loop control tester in accordance with operating instructions to pin A of diagnosis connection (in relay plate on left-hand side of engine compartment).		
2	Frequency valve	Jumper electrical safety circuit. To do so, detach connector at air-flow sensor. Switch on ignition. Frequency valve must be heard and felt to operate (chatter).		Open-circuit in voltage supply for K-control unit or frequency valve. Control unit or frequency valve defective. Resistance value for frequency valve: 2...3 Ω
3	On/off ratio t 1 (open-loop control)	Detach connector of lambda-sensor lead (green wire). On/off-ratio reading:	 45...55 %	Frequency valve defective. Resistance value 2...3 Ω . Short-circuit of sensor lead to positive or ground. Open-circuit in diagnosis connection.
4	On/off ratio t 0 (lean stop)	Connect control-unit-end plug of sensor lead to 2 V connection of lambda closed-loop control tester. On/off ratio drops to:	 max. 20 %	Open-circuit in sensor lead. Control unit defective.
5	On/off ratio t 2 (rich stop)	Connect control-unit-end plug of sensor lead to ground. On/off ratio increases to:	 min. 87 %	Control unit defective.
6	Lambda sensor - short-circuit or open-circuit	Connect connector of sensor lead. On/off ratio corresponding to t 1:	 45...55 %	Lambda sensor defective (short-circuit or open-circuit).

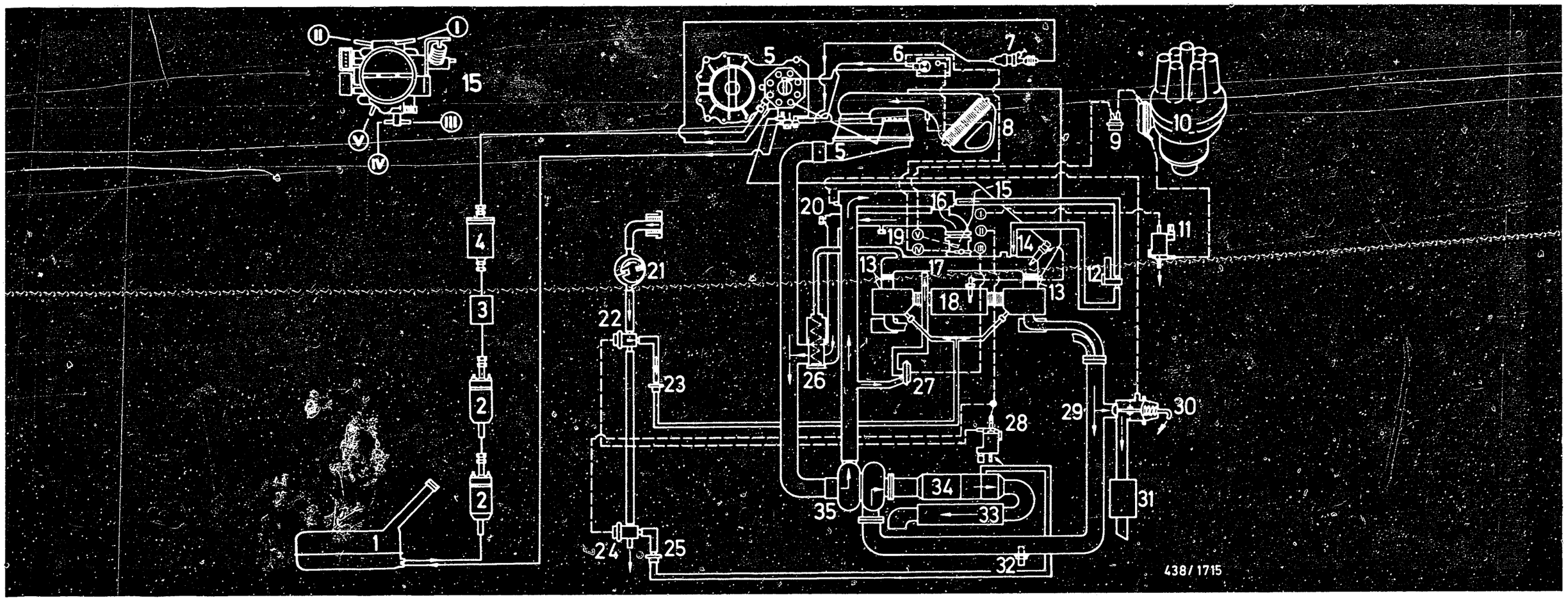
RAPID DIAGNOSIS CHART FOR LAMBDA CLOSED-LOOP CONTROL (CONTINUED)

No.	Testing of component/function	Test instructions, test conditions	Set values	Possible cause of fault
7	On/off ratio t 4 (acceleration enrichment)	Detach plug at acceleration enrichment relay and connect pin 10 of plug to ground. On/off ratio goes to: Note: If t 4 O.K., but acceleration behavior is not satisfactory, the components B1, B2, S2 and X2 and their wiring are to be tested individually in accordance with the circuit diagram or X2 is to be replaced. Refer also to description under "Special features".	68...82 %	Open-circuit in lead from pin 10 of control unit for acceleration enrichment to pin 12 of K-control unit or K-control unit defective.
8	Closed-loop control function	Connect plug to air-flow sensor. Warm up engine again, then allow to idle. System must exhibit closed-loop control, i.e. pulsating on/off-ratio reading. Mean value of pulsating reading:	45...55 %	No closed-loop control: lambda sensor or K-control unit defective. Incorrect value: idle-speed setting incorrect (Coordinate 11/12)
9	On/off ratio t 5 (full load, temp. switch 15° C)	Allow engine to idle. Detach connector at 15° C temperature switch and hold it against ground. On/off ratio assumes static reading: Note: To ensure that t 5 is also obtained with full load and engine-speed limitation, the full-load switch S2 and the wiring to the K-control unit as well as to the engine-speed relay K5 are additionally to be individually tested in accordance with the circuit diagram.	45...55 %	Open-circuit in lead from temperature switch to K-control unit, pin 7.
10	Lambda-sensor heater	Note on function: The sensor is heated from idle speed to approx. 3000 min^{-1} . Allow engine to idle. 1. Disconnect 2-pole connector (to lambda sensor) and measure voltage between the two pins: 2. Measure resistance at both pins of sensor-end plug half. Set value:	Battery voltage 1...12 Ω	Re 1.: Engine-speed relay K5 defective or open-circuit in wiring. Re 2.: Lambda sensor defective.



A1 = Ignition trigger box, term. 13
B1 = Heated lambda sensor
B2 = Charge-air-pressure switch
B3 = 15° C temperature switch
B4 = 35° C temperature switch
B5 = Ignition trigger box, term. TD
F1 = Fuse box 1, fuse 3
F2 = Fuse box 1, connection X
G1 = Alternator, term. B+
K1 = Relay for electric fuel pump I
K2 = Relay for electric fuel pump II
K3 = Supply relay, control units
K4 = Engine-speed relay
K5 = Ignition time-lag relay
K6 = Electric-fuel-pump control relay
K7 = Thermo-time switch
S1 = Throttle-valve switch: idle, 7°, full load
S2 = Air-flow-sensor contact
X1 = Plug, control unit, lambda closed-loop control
X2 = Control unit, acceleration enrichment
X3 = Diagnosis connection (on/off ratio)
Y1 = Frequency valve, lambda system
Y2 = Auxiliary-air device
Y3 = Electric fuel pump I
Y4 = Electric fuel pump II
Y5 = Warm-up regulator
Y6 = Start valve
Y7 = Switching valves, vacuum retard unit, ignition distributor

ELECTRICAL CIRCUIT DIAGRAM; SAFETY CIRCUIT



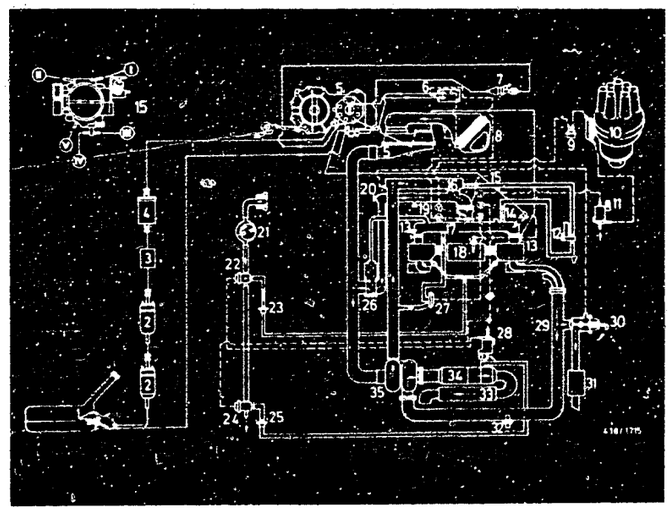
1 = Fuel tank
2 = Electric fuel pumps
3 = Fuel accumulator
4 = Fuel filter
5 = Mixture control unit
6 = Warm-up regulator
7 = Frequency valve
8 = Air filter
9 = Thermo-valve
10 = Ignition distributor
11 = Solenoid-operated change-over valve
12 = Auxiliary-air device
13 = Injection valves
14 = Start valve
15 = Throttle-valve assembly
16 = Charge-air cooler
17 = Air distributor
18 = 35° C temperature switch
19 = Charge-air-pressure sensor
20 = Charge-air-pressure switch
21 = Secondary air pump
22 = Blow-off change-over valve
23 = Non-return valve
24 = Blow-off change-over valve
25 = Non-return valve
26 = Charge bypass valve
27 = Vacuum limiter
28 = Solenoid-operated change-over valve
29 = Exhaust pipe
30 = Charge-air-pressure control valve
31 = Bypass muffler
32 = Lambda sensor
33 = Exhaust muffler
34 = Catalytic converter
35 = Turbocharger

——— Fuel lines

– – – – Vacuum lines

DIAGRAM OF FUEL AND AIR LINES FOR ENGINE

DIAGRAM OF FUEL AND AIR LINES (CONTINUED)



Explanatory notes on functions of individual components:

Secondary air injection (auxiliary air):

Injection following cold start below 35° C for 1 minute into intake system in area of intake valves. Following completion of 1 minute period, switching of auxiliary air to output stage of catalytic converter 34. Control of both phases by solenoid-operated change-over valve 28 and the two vacuum-dependent blow-off change-over valves 22, 24.

1st phase: The solenoid-operated change-over valve 28 is provided with voltage by the control unit for acceleration enrichment following cold starting below 35° C and establishes a vacuum connection to the change-over valve 22 for 1 minute. This opens and routes auxiliary air via the non-return valve 23 to the intake system.

2nd phase: The solenoid-operated change-over valve 28 closes after 1 minute. The change-over valve 22 switches and auxiliary air is passed to the change-over valve 24. This only opens in the event of part load as a result of vacuum and routes auxiliary air to the catalytic converter.

Timing control:

Solenoid-operated change-over valve 11: Actuation by way of control unit for acceleration enrichment. Following cold starting below 35° C, it interrupts the application of vacuum to the ignition-distributor vacuum retard unit for 1 minute. The ignition point is thus advanced in this phase and there is therefore a higher idle speed (reduction of exhaust pollution).

Thermo-valve 30: This valve controls the vacuum advance unit of the ignition distributor which takes effect at part load. The valve is closed when the engine is cold up to 60° C. Vacuum-induced advance is thus avoided in this range (reduction of exhaust pollution).

Re Item 16 - charge bypass valve (for overrun operation):

The bypass valve opens as a result of the high vacuum during overrun. Part of the charge is passed via the bypass valve back to the intake line. This stops the charger speed decreasing excessively in overrun operation and thus ensures that the full engine power is immediately available again on re-accelerating.

INSTALLATION POSITION OF COMPONENTS; IMPORTANT ASSEMBLY INFORMATION

Top picture, air filter removed:

1 = Mixture control unit
2 = Warm-up regulator
3 = Auxiliary-air device
4 = EGR valve
5 = Injection valve, cyl. 6 (others not visible in picture)

Virtually all work on the K-Jetronic presupposes removal of the air filter. This necessitates removal of the A/C compressor. To do so, unscrew the three fastening screws, remove compressor with connected hoses and have a second person hold it whilst removing air filter. Then set compressor down loosely on bracket.
When installing compressor, set V-belt tension such that V-belt can be deflected easily by 2...3 mm in the center between the two pulleys.

Removal of air filter: Unscrew three fastening screws. Detach hose to oil tank at oil tank. Detach other hoses at air filter.

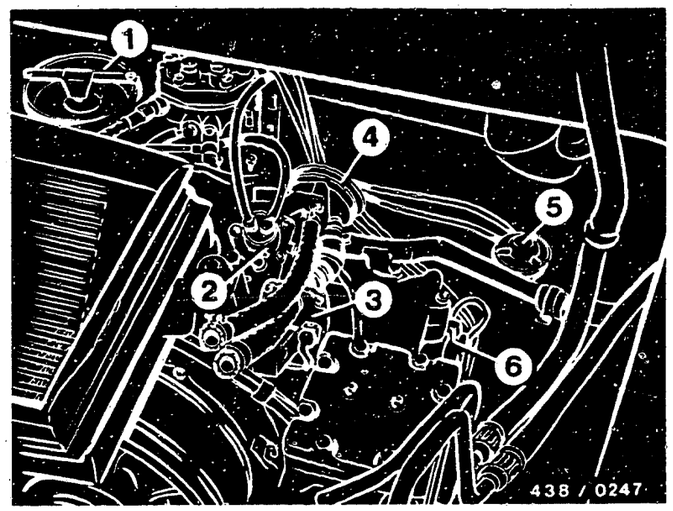
Notes on removal and installation of mixture control unit (center and bottom pictures):

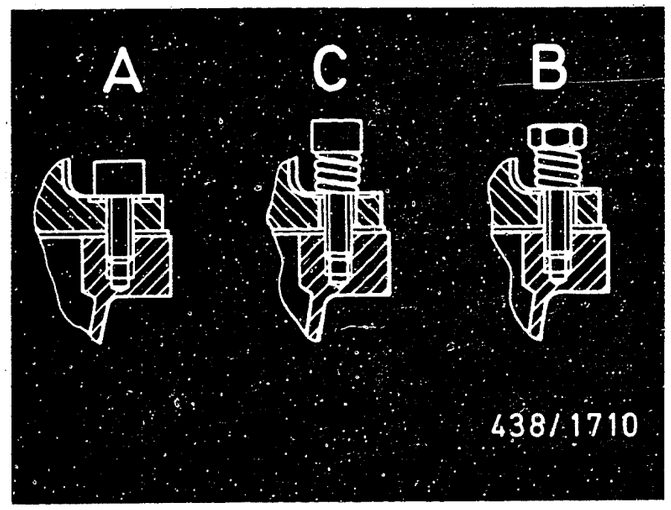
Clean and unscrew all fuel lines.
Unscrew fastening screws and detach mixture control unit from bracket.

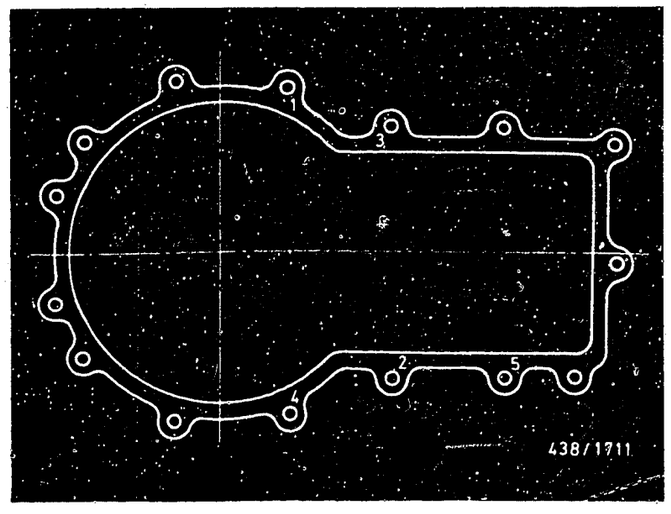
Always install with new flange seal (Porsche service part).
Determination of fastening screws in accordance with center and bottom pictures:

Center picture: A = Screws 1...4
B = Screw 5
C = Other screws

Tighten fillister-head screws 1...4 (without springs) alternately to 10 Nm. Tighten remaining fillister-head screws and hexagon bolt 5 (5 mm longer) with springs and washers as far as they will go, then slacken off by one turn.







INSTALLATION POSITION OF COMPONENTS; IMPORTANT ASSEMBLY INFORMATION (CONTINUED)

The charge-air cooler is to be removed, so as to provide access to the vacuum limiter, the thermo-valve and the injection valves of the left-hand cylinder bank etc:

Unscrew the total of 4 fastening screws. Detach all hoses and remove charge-air cooler. When installing, always make use of new seals at throttle-valve assembly and air supply pipe (Porsche service parts).

The electric fuel pumps are located on the underside of the vehicle. Pump I at the front-axle cross member, pump II in front of the left-hand rear wheel.

Refer to top picture for fuel filter -7- and fuel accumulator -8-.

Cold-start valve at air distributor (on back of engine) beneath throttle-valve-assembly flange.

Charge-air-pressure switch in charge-air cooler, left.

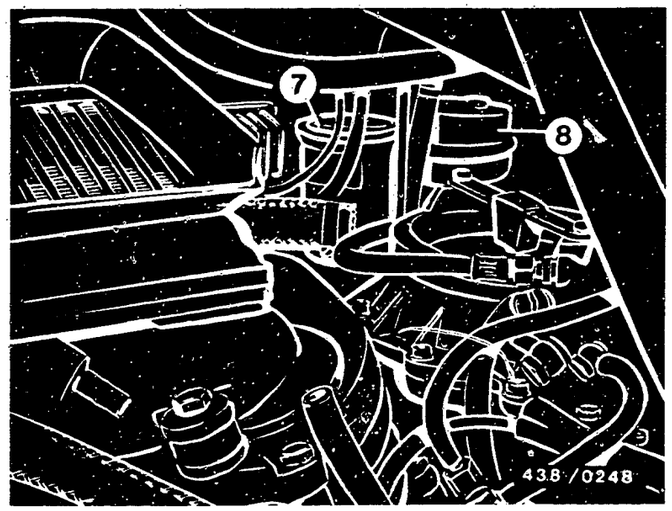
Tank valve on left next to mixture-control-unit bracket.

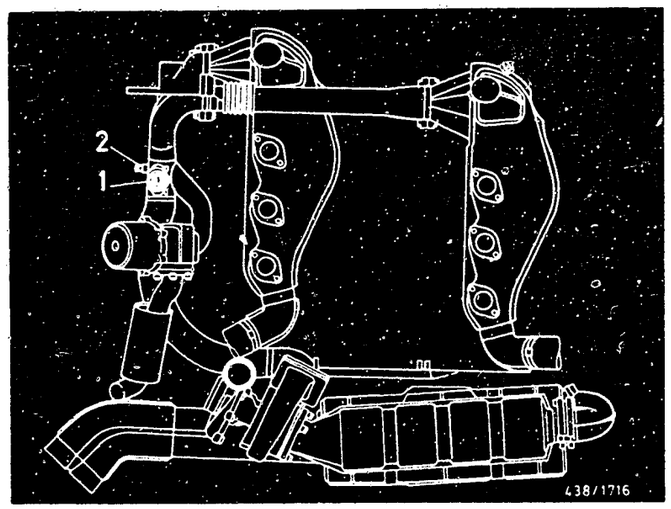
The lambda control unit, the control unit for acceleration enrichment and the engine-speed relay are fitted beneath the driver's seat.
Note: Always only detach and connect control-unit connectors with switched-off ignition and safety circuit.

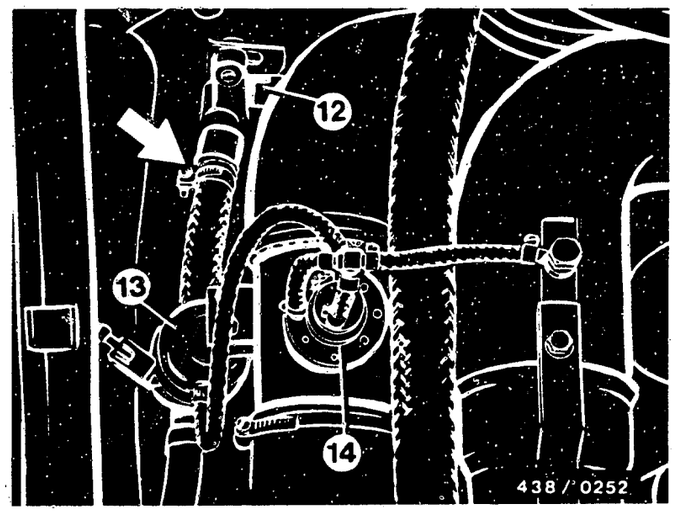
The lambda sensor (1, center picture) and the exhaust-gas sampling connection (2) are located in the exhaust pipe on the left in front of the charge bypass valve.
Note: Coat thread of lambda sensor and screw plug prior to assembly with special assembly paste VS 14 016 Ft (5 964 080 105).

Refer to bottom picture for secondary air system: 12 - secondary pump, 13 - blow-off change-over valve, 14 - control valve for secondary air.

The relays K1...K3 for the electric fuel pumps are located in the central electrics console in the trunk (on left in direction of travel, rear relays).







Trouble-shooting instructions	:	OPE--5016
BOSCH system	:	EI
Make of vehicle	:	OPEL
Basic microcard	:	PKW- 121

TABLE OF CONTENTS

SPECIAL FEATURES

These brief instructions, valid at the time of publication, apply to the following Opel model:

Senator-B with 3.0 l/ 6-cyl. engine 30 NE 1.88 ->.

* Ignition advance unit 0 227 921 050
* Trigger box 0 227 100 124 (with current limitation)
* Ignition coil 1 227 020 009
* Ignition coil with trigger box 0 221 600 005
* Ignition advance unit term. 5 (engine-speed signal/TD) or term. 8 (engine intervention) is monitored by the transmission control (self-diagnosis). For further information refer to basic microcard "transmission control".

STRUCTURE AND USAGE

These brief instructions encompass essentially vehicle-specific special features and test specifications (set values).

In accordance with the customer complaint, the trouble-shooting chart leads to different causes/component faults. For a detailed description of trouble-shooting, see the information in the trouble-shooting chart of the basic instructions.

ATTENTION: Even if reference is made to basic instructions, the set values, terminal assignments and special features of these vehicle-related brief instructions are always binding.

SAFETY AND PRECAUTIONARY MEASURES

In order to keep persons out of danger and to avoid damage to the engine, trigger boxes and control units or to the ignition system, observe the information in the basic instructions.

CAUTION!
High-performance ignition system with dangerous primary and secondary voltages!

Touching voltage-carrying components or terminals may prove fatal (both on the primary and secondary sides).

TROUBLE-SHOOTING CHART

Customer complaint (fault symptoms)

1. Starting motor operates, engine fails to start or starts only with difficulty.	2. Engine starts but then dies.	3. Idle problems (engine speed, exhaust gas).	4. Poor throttle take-up, flat spot during acceleration.	5. Engine missing (ignition, injection).	6. Maximum engine power/ top speed not reached.	7. Fuel consumption too high.	8. Engine running on (dieseling).	9. Engine pinging/knocking.	10. Engine overheating.	11. Fault lamp.	Cause (component fault)
*				*							High-tension side
*											Firing sequence
*				*							Ignition coil
*											Ignition-distributor installation setting
*											Trigger-box voltage
*											Primary-circuit voltage
*											Ignition-distributor plug and socket
*											Magnetic-pulse-generator voltage
*											Magnetic-pulse-generator function
*											Ignition-advance-unit function
*											Contact resistance (primary side)
*											Engine-speed signal
*											Primary signal
*		*	*		*	*		*	*		Basic ignition setting
					*	*					Control lead, characteristic-curve control
					*	*					Temperature switch (oil)
					*	*					Temp. switch (intake manifold)
		*	*		*	*					Throttle-valve switch (idle/full load)

TROUBLE-SHOOTING CHART (CONTINUED)

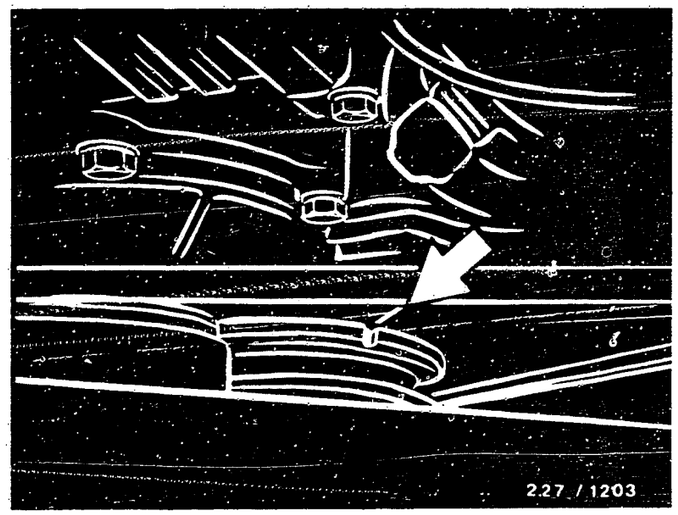
Customer complaint (fault symptoms)

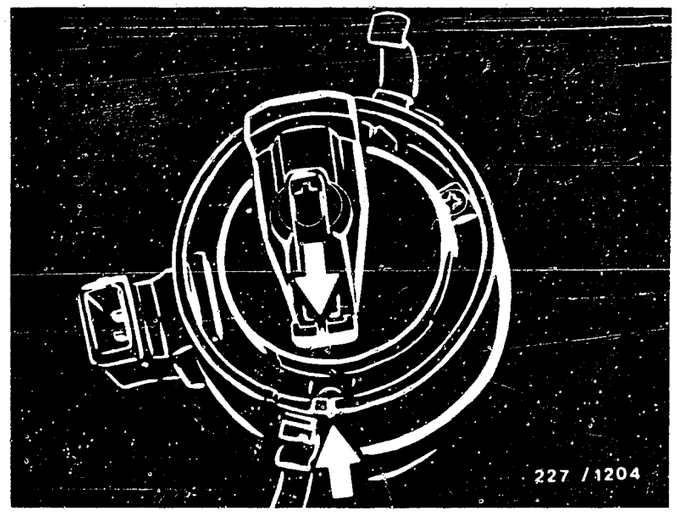
1. Starting motor operates, engine fails to start or starts only with difficulty.	2. Engine starts but then dies.	3. Idle problems (engine speed, exhaust gas).	4. Poor throttle take-up, flat spot during acceleration.	5. Engine missing (ignition, injection).	6. Maximum engine power/ top speed not reached.	7. Fuel consumption too high.	8. Engine running on (dieseling).	9. Engine pinging/knocking.	10. Engine overheating.	11. Fault lamp.	Cause (component fault)
				*	*						Load signal
			*								Trigger-box voltage (engine idling)
			*								Ignition-coil voltage (engine idling)
			*								Primary voltage (engine idling)

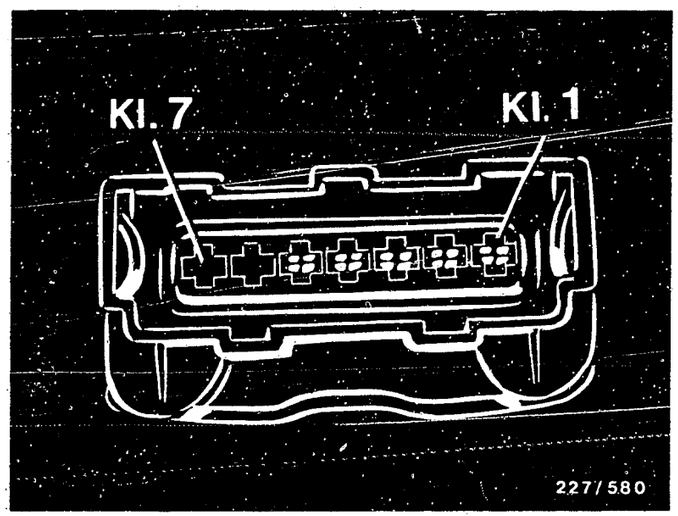
For production reasons:
continued on the following
coordinate.

RAPID DIAGNOSIS CHART

Test step	Testing of component/function Test instructions/conditions	Terminals	Set values
1	HIGH-TENSION SIDE Test functioning of for example spark plugs, ignition harness and distributor cap (e.g. open-circuit, shunt). Assess for example by way of ignition oscillogram, resistance measurement, visual inspection.	——	——
2	IGNITION COIL Visual inspection: Plug present, sealing compound oozed out? Primary resistance Secondary resistance	 1 15 1 4	 0.6...1.0 Ω 6.4...11.1 k Ω
3	IGNITION-DISTRIBUTOR INSTALLATION SETTING Engine cyl. no. 1 on pulley mark (10° BTDC). See top picture, arrow. Center of distributor-rotor electrode points towards mark on housing. See center picture, arrow.	——	——
4	TRIGGER-BOX VOLTAGE Detach trigger-box plug. See bottom picture. Ignition ON. Trigger-box-plug voltage.	 4 (+) 2 (−)	 Battery voltage
5	PRIMARY-CIRCUIT VOLTAGE Trigger-box plug detached. See bottom picture. Ignition ON. Trigger-box-plug voltage.	 1 (+) 2 (−)	 Battery voltage

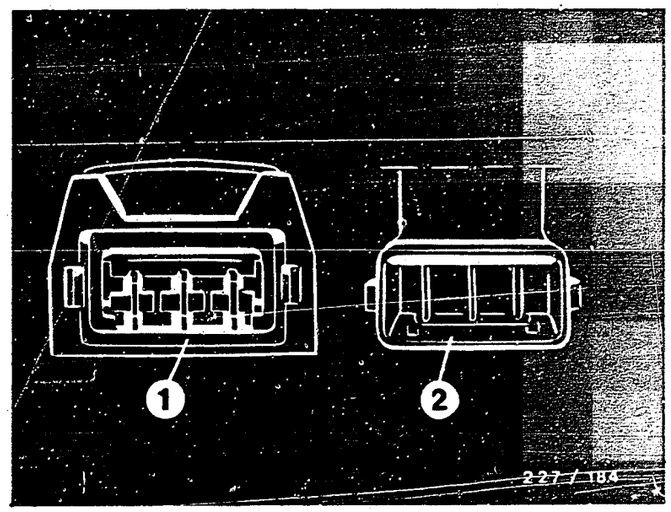


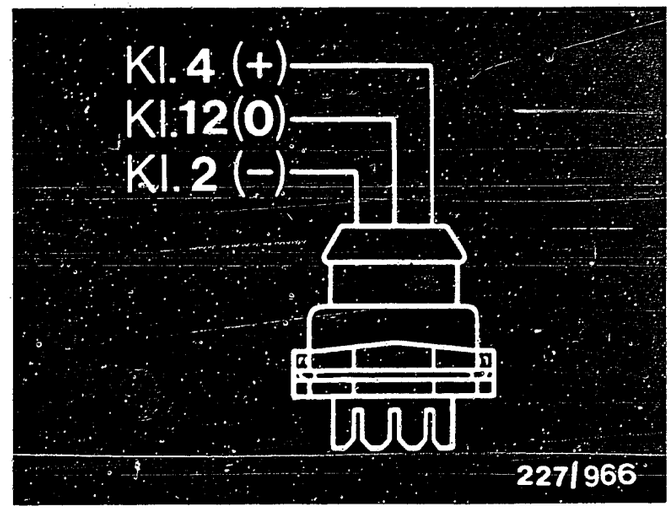


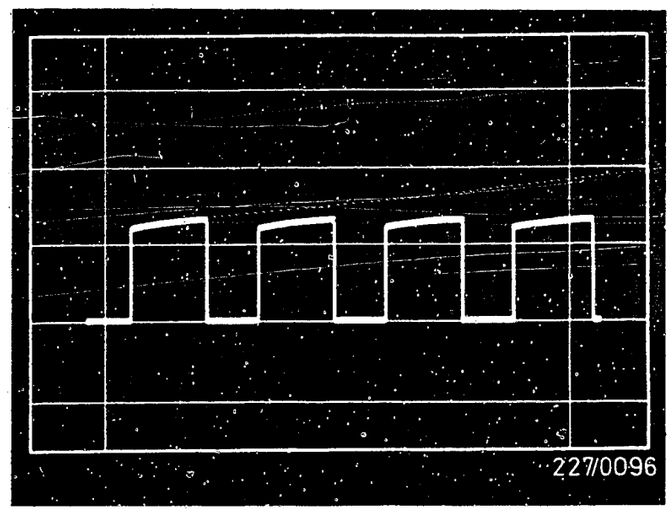


RAPID DIAGNOSIS CHART (CONTINUED)

Test step	Testing of component/function Test instructions/conditions	Termin-als	Set values
6	IGNITION-DISTRIBUTOR PLUG AND SOCKET Detach ignition-distributor plug. Visual inspection: Check ignition-distributor plug and socket for oxidation. See top picture.	——	——
7	MAGNETIC-PULSE-GENERATOR VOLTAGE Attach ign.-distributor and trigger-box plug. Push back rubber sleeve of ignition-distributor plug. Ignition ON. Ignition-distributor-plug voltage. See center picture.	4 (+) 2 (-)	equal to/greater than 10 V
8	MAGNETIC-PULSE-GENERATOR FUNCTION Oscilloscope "special" to ignition-distributor plug and vehicle ground. See center picture. Start engine.	12 (+) B- (-)	Rectangular pulse (bottom picture)
9	IGNITION-ADVANCE-UNIT FUNCTION Push back rubber sleeve of trigger-box plug. Oscilloscope "special" to trigger-box plug and vehicle ground. Start engine.	5 (+) B- (-)	Rectangular pulse (bottom picture)

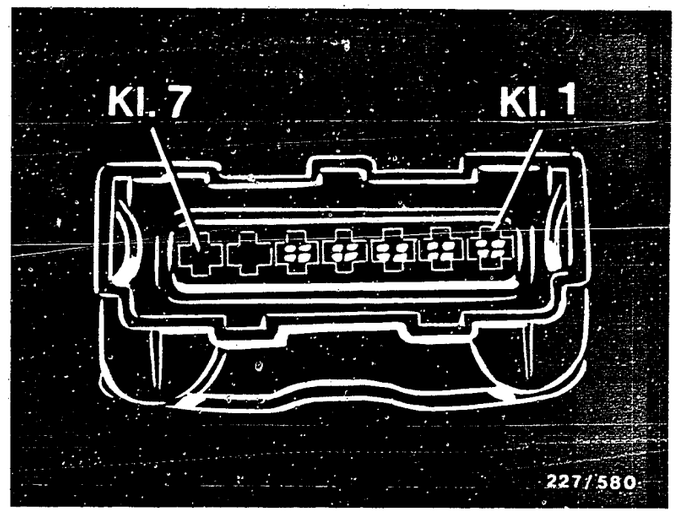


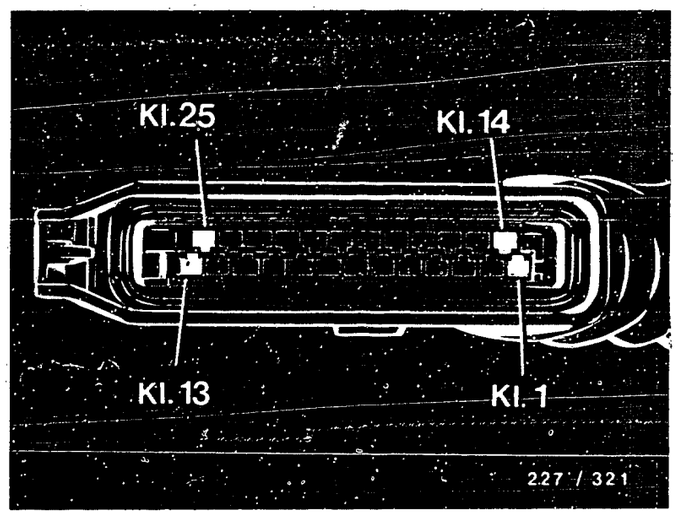


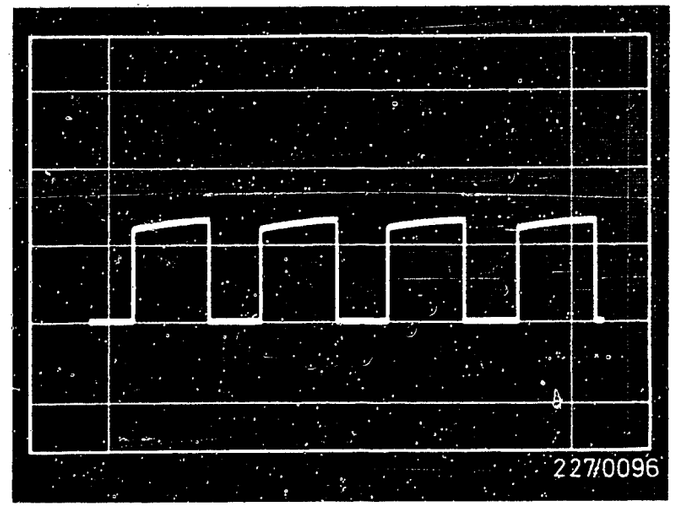


RAPID DIAGNOSIS CHART (CONTINUED)

Test step	Testing of component/function Test instructions/conditions	Termin-als	Set values
10	CONTACT RESISTANCE (PRIMARY SIDE) Detach negative and positive lead of battery. Detach trigger-box plug. See top picture. Ignition ON. Resistance from battery terminal to trigger-box plug. Resistance from battery terminal to ign. coil. Resistance from ign. coil to trigger-box plug.	B+ 4 B– 2 B+ 15 1 1	max. 0.3 Ω max. 0.3 Ω
11	ENGINE-SPEED SIGNAL Connect negative and positive lead to battery. Attach trigger-box plug. Detach LE-Jetronic control-unit plug. See center picture. Oscilloscope "special" to LE-Jetronic control-unit plug and vehicle ground. Start engine.	15 B– (+) (–)	Rectangular pulse (bottom picture)
12	PRIMARY SIGNAL Attach LE-Jetronic control-unit plug. Oscilloscope/engine-speed tester to ignition coil. Start engine.	15 1 (+) (–)	Primary voltage/ engine-speed display (magnitude irrelevant)

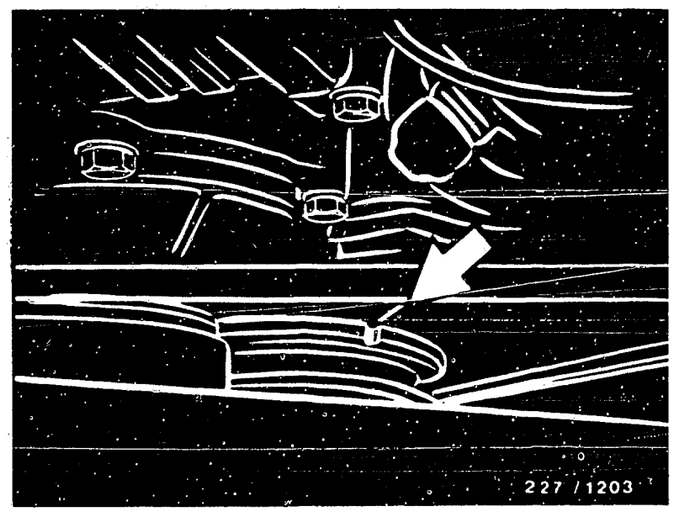


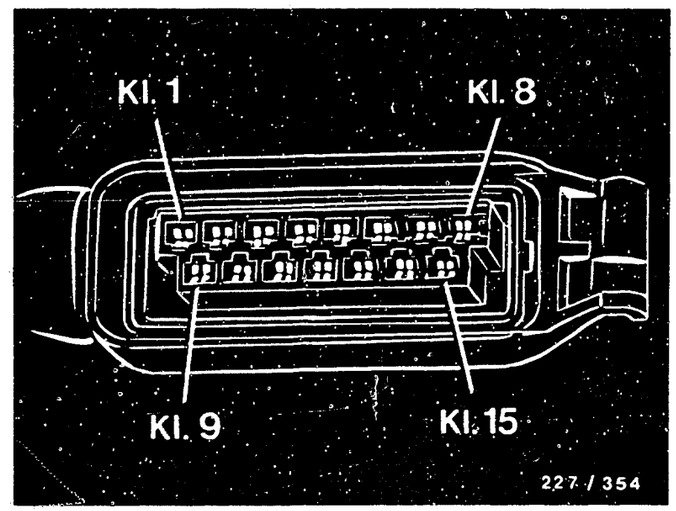




RAPID DIAGNOSIS CHART (CONTINUED)

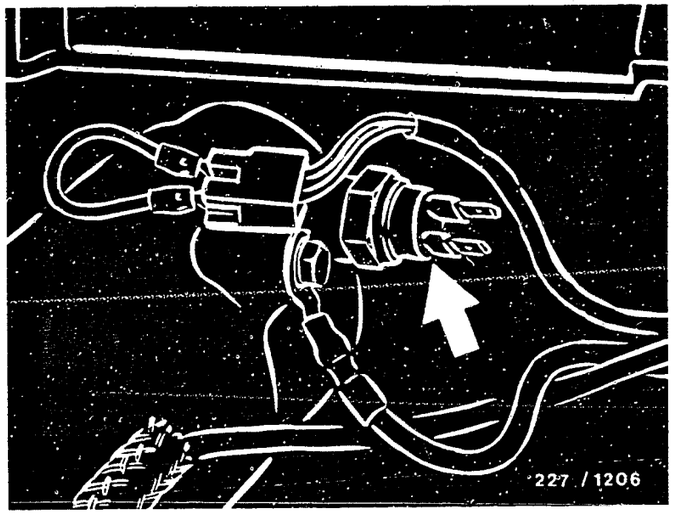
Test step	Testing of component/function Test instructions/conditions	Termin-als	Set values
13	BASIC IGNITION SETTING Engine at op. temp. (oil temp. approx. 80°C). Ignition OFF. Connect Motortester in accordance with operating instructions. Detach throttle-valve-switch plug and jumper terminals 4, 5 and 6 with auxiliary lead. See top picture, arrow. Run engine at 700...1000 min $^{-1}$. Read off ignition angle/flash lamp at ignition marks (mark corresponds to 10° BTDC). See center picture, arrow. Remove auxiliary lead. Clear transmission-control fault memory. To do so, detach negative terminal of battery for approx. 1 minute. See basic microcard for further information. SPECIAL FEATURES Section.	——	10° ± 2° BTDC
14	CONTROL LEAD, CHARACTERISTIC-CURVE CONTROL Detach plug of temperature switch (oil) and temperature switch (intake manifold) and jumper both plugs in each case with auxiliary lead. Detach ignition-advance-unit plug. See bottom picture. Ignition ON. Voltage of ignition-advance-unit plug.	3 (+) 7 (−)	Battery voltage
15	TEMPERATURE SWITCH (OIL) Temperature-switch plug detached. Temperature-switch resistance.	——	Less than approx. +65°C approx. 0 Ω (continuity) Greater than approx. +65°C infinity Ω (open-circuit)

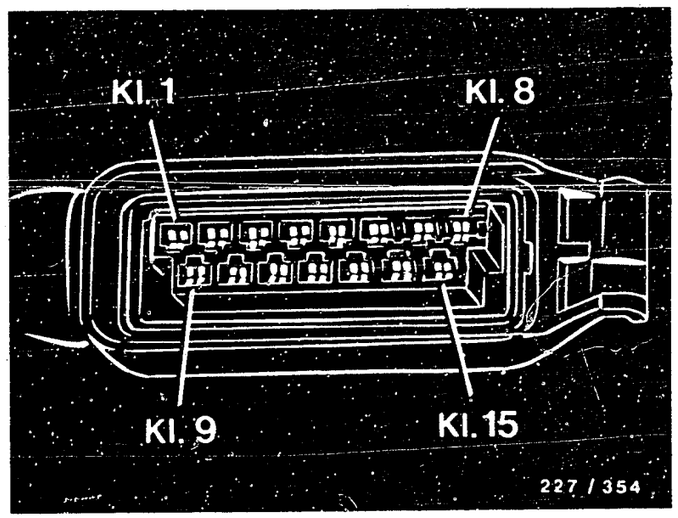


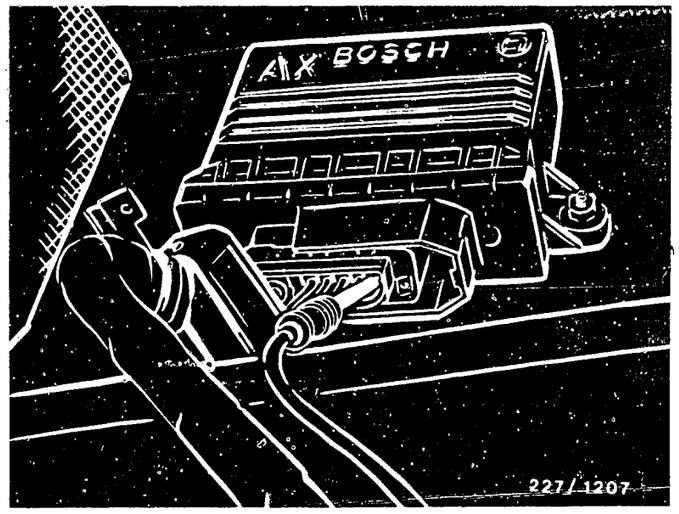


RAPID DIAGNOSIS CHART (CONTINUED)

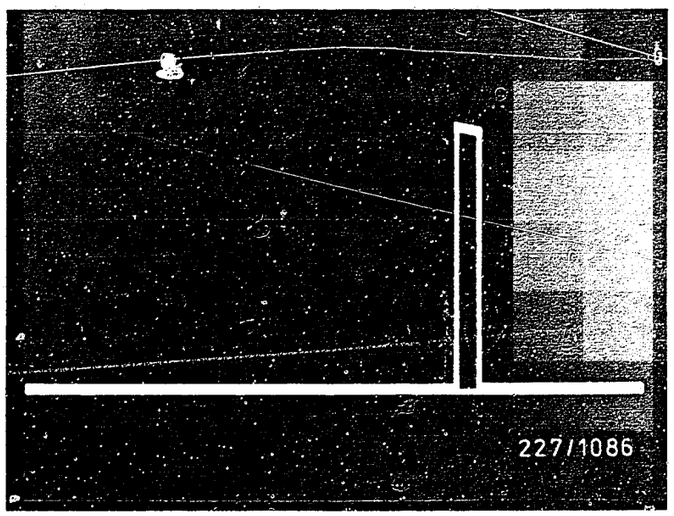
Test step	Testing of component/function Test instructions/conditions	Termin-als	Set values
16	TEMPERATURE SWITCH (INTAKE MANIFOLD) Temperature-switch plug (intake manifold) detached. Temperature-switch resistance. See top picture, arrow.	——	Greater than approx. +17°C approx. 0 Ω (continuity) Less than approx. +17°C infinity Ω (open-circuit)
17	THROTTLE-VALVE SWITCH (IDLE/FULL LOAD) Detach ignition-advance-unit plug. Voltage of ignition-advance-unit plug. See center picture. Throttle valve in idle position. Briefly start engine. Voltage of ignition-advance-unit plug. Completely open throttle valve. Briefly start engine.	6 1 (+) (−) 14 1 (+) (−)	 Approx. battery voltage Approx. battery voltage
18	LOAD SIGNAL Attach ignition-advance-unit plug with handle cover removed. See bottom picture. Oscilloscope "special" to ignition-advance-unit plug and vehicle ground. O R Dwell-angle tester to battery and ignition-advance-unit plug.	15 B− (+) (−) B+ 15 (+) (−)	

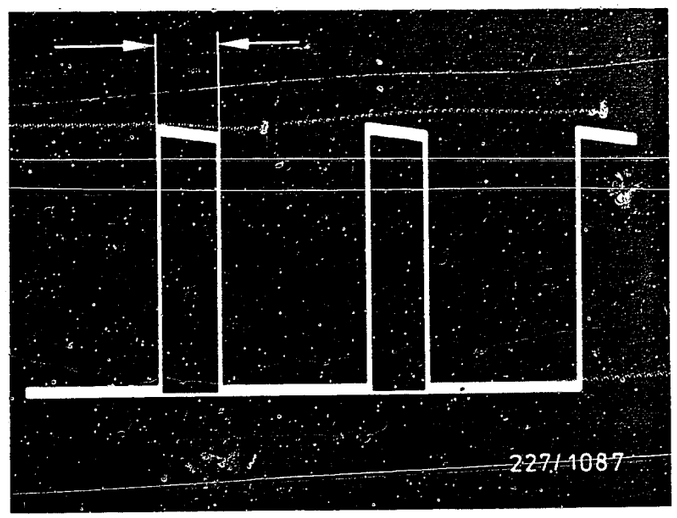






Test step	Testing of component/function Test instructions/conditions	Terminals	Set values
18	LOAD SIGNAL (CONTINUED) Allow engine to idle. Load signal must be present/read off and note down dwell angle. Briefly accelerate to full throttle and observe load signal/dwell-angle reading. There must be a noticeable change in the pulse duration of the load signal or in the dwell-angle value.	—— ——	Load signal (top picture) Load signal (center picture, arrow)
19	TRIGGER-BOX VOLTAGE Push back rubber sleeve of trigger-box plug. Trigger-box-plug voltage. See bottom picture. Engine idling.	4 2 (+) (–)	12 – 14 V max. 1 V below U_B
20	IGNITION-COIL VOLTAGE Voltage at ignition coil and battery. Engine idling.	15 B– (+) (–)	equal to/greater than 10 V
21	PRIMARY VOLTAGE Oscilloscope with pulse-shaping circuit to ignition coil. Engine idling.	15 1 (+) (–)	295 – 365 V





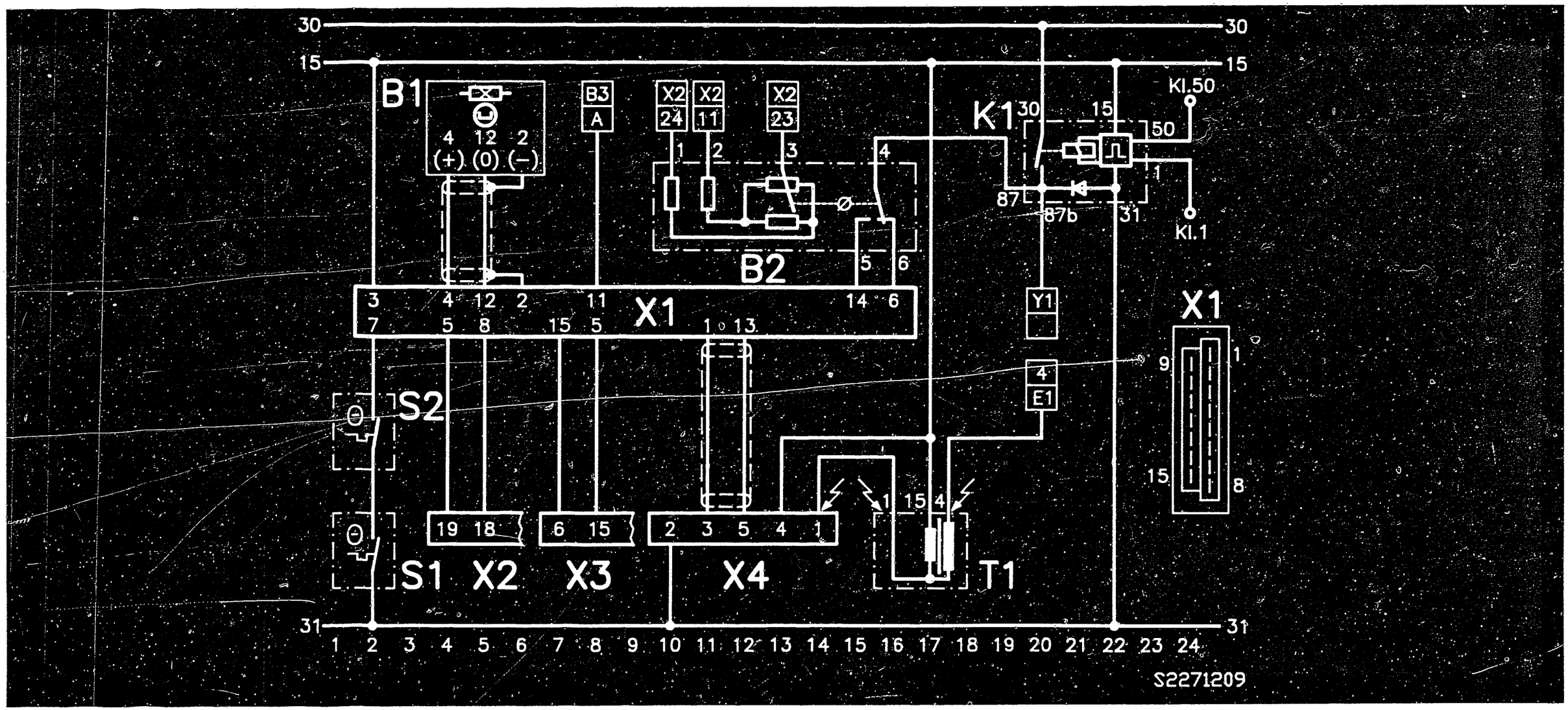
TEST SPECIFICATIONS

Ignition coil, primary	0.6...1.0 Ω
Ignition coil, secondary	6.4...11.1 k Ω
Ignition-distributor installation setting	Cyl. no. 1 10° BTDC ID-mark
Trigger-box voltage on ignition	Battery voltage
Primary-circuit voltage with ignition ON	Battery voltage
Magnetic-pulse-generator voltage with ignition ON	equal to/greater than 10V
Magnetic-pulse-generator function at cranking speed	Rectangular pulse
Ignition-advance-unit function at cranking speed	Rectangular pulse
Contact resistance	
Supply leads	
Trigger box	max. 0.3 Ω
Primary circuit	max. 0.3 Ω
Engine-speed signal at cranking speed	Rectangular pulse
Primary signal at cranking speed	Primary voltage/ engine-speed indication
Basic ignition setting	
Engine-oil temperature approx.	+ 80° C
Throttle-valve-switch plug term. 4, 5 and 6 jumpered.	
Engine speed 700-1000 min $^{-1}$	10° ± 2° BTDC

TEST SPECIFICATIONS (CONTINUED)

Control lead, characteristic-curve control with ignition ON	Battery voltage
Temperature switch (oil)	Less than approx. +65° C Approx. 0 Ω (continuity) Greater than approx. 65°C Infinity (open-circuit)
Temperature switch (intake manifold)	Greater than approx. +17 °C Approx. 0 Ω (continuity) Less than approx. + 17° C Infinity Ω (open-circuit)
Throttle-valve switch at cranking speed	
Idle position	Approx. battery voltage
Full-throttle position	Approx. battery voltage
Load signal Briefly accelerate to full throttle.	There must be a change in pulse duration.
Trigger-box voltage with engine idling	12...14 V max. 1 V below U_B
Ignition-coil voltage with engine idling	Greater than/equal to 10 V
Primary voltage with engine idling	295...365 V

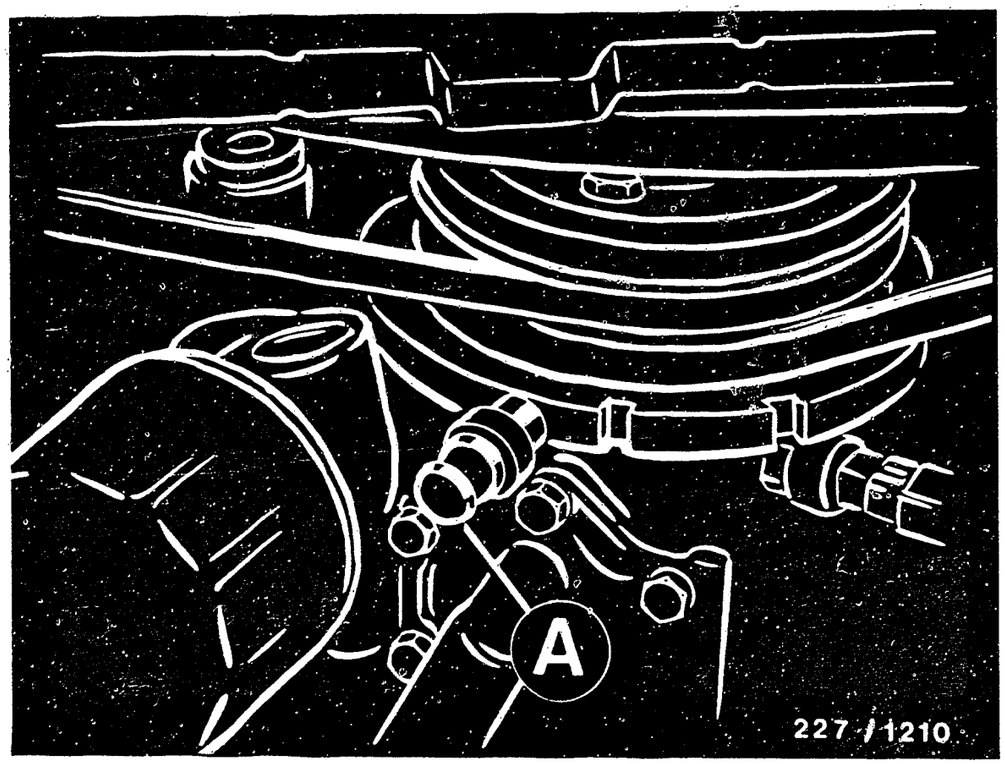
Please refer to SIS Microcard, Jetronic and Autodata test specifications for settings as regards idle speed, exhaust gas, valve clearance etc.



High-tension arrows: Caution 400 V...25 kV

B1 = Magnetic pulse generator (ign. dist.)
B2 = Throttle-valve switch with potentiometer
B3 = to idle-speed regulator
E1 = to ignition distributor
K1 = Control relay (LE-Jetronic)
S1 = Temperature switch (oil)
S2 = Temperature switch (intake manifold)
T1 = Ignition coil
X1 = Ignition-advance-unit plug
X2 = Transmission control - control-unit plug
X3 = LE-Jetronic control-unit plug
X4 = Trigger-box plug
Y1 = Electric fuel pump

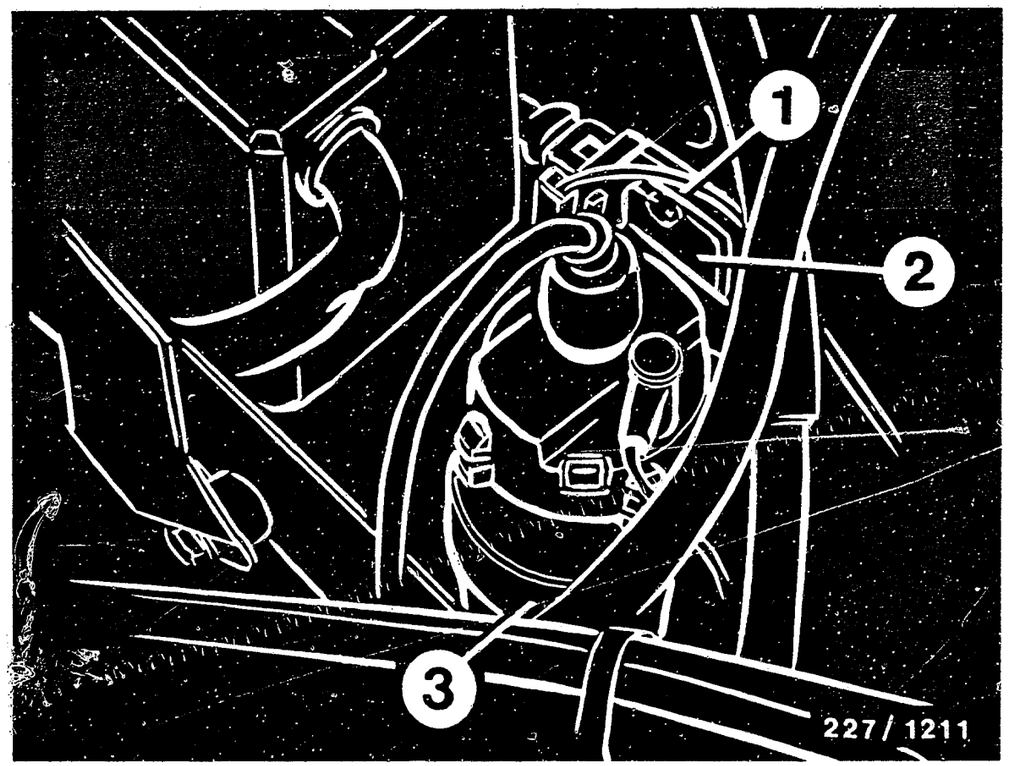
ELECTRICAL TERMINAL DIAGRAM



A = Plug for TDC sensor

INSTALLATION POSITION OF COMPONENTS

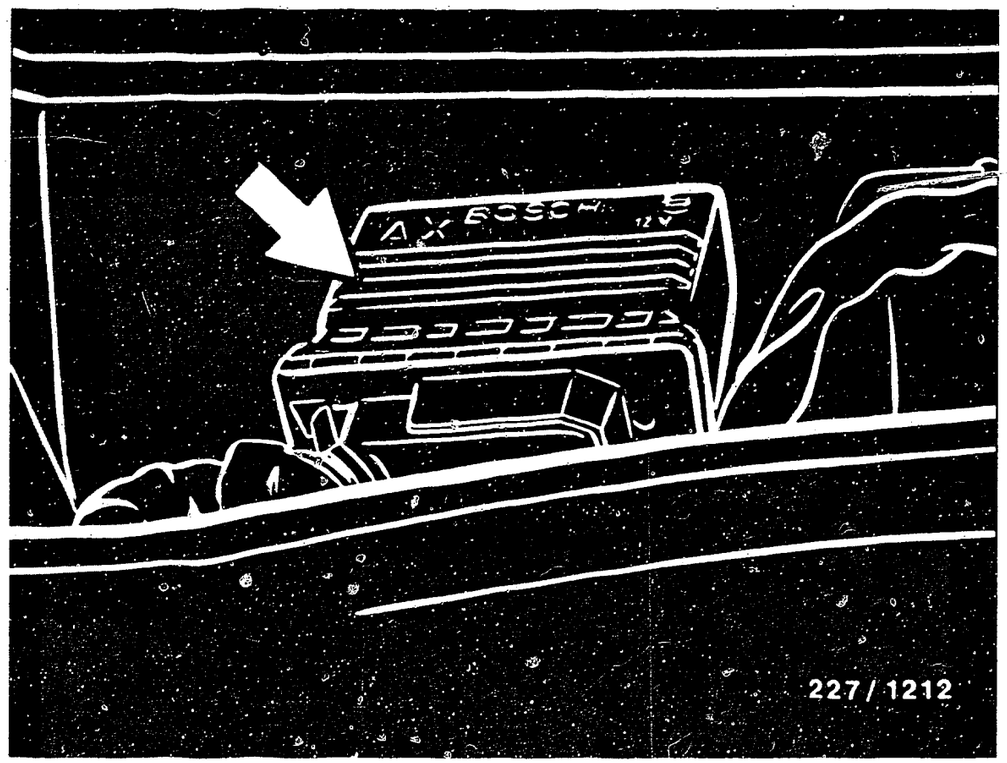
Motortester (TDC sensor) connection:
Remove plug "A" (see picture) and insert TDC sensor as far as it will go into sleeve of control housing.



1 = TI trigger box
2 = Heat sink
3 = Ignition coil

INSTALLATION POSITION OF COMPONENTS (CONTINUED)

The trigger box and ignition coil are installed on a joint heat sink. See picture.



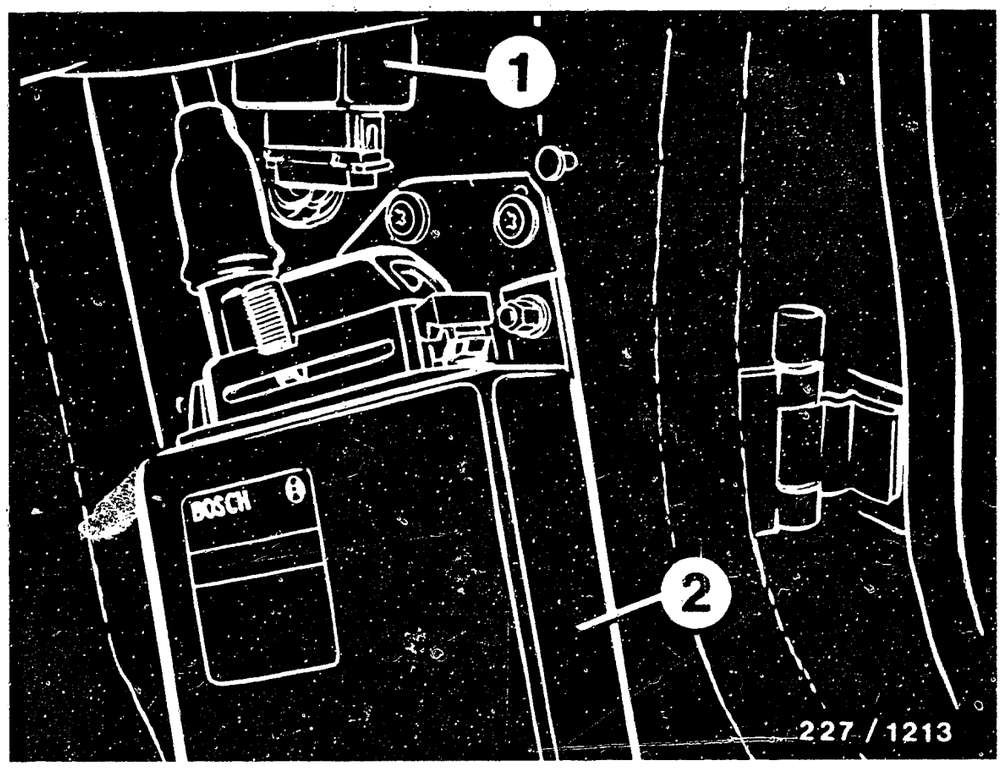
Arrow = Ignition advance unit

INSTALLATION POSITION OF COMPONENTS (CONTINUED)

The ignition advance unit is located on the right-hand side of the vehicle. See picture.

Removal:

Raise cover of plenum chamber.
Unscrew fastening nuts.
Press back retaining spring, tilt and remove plug.

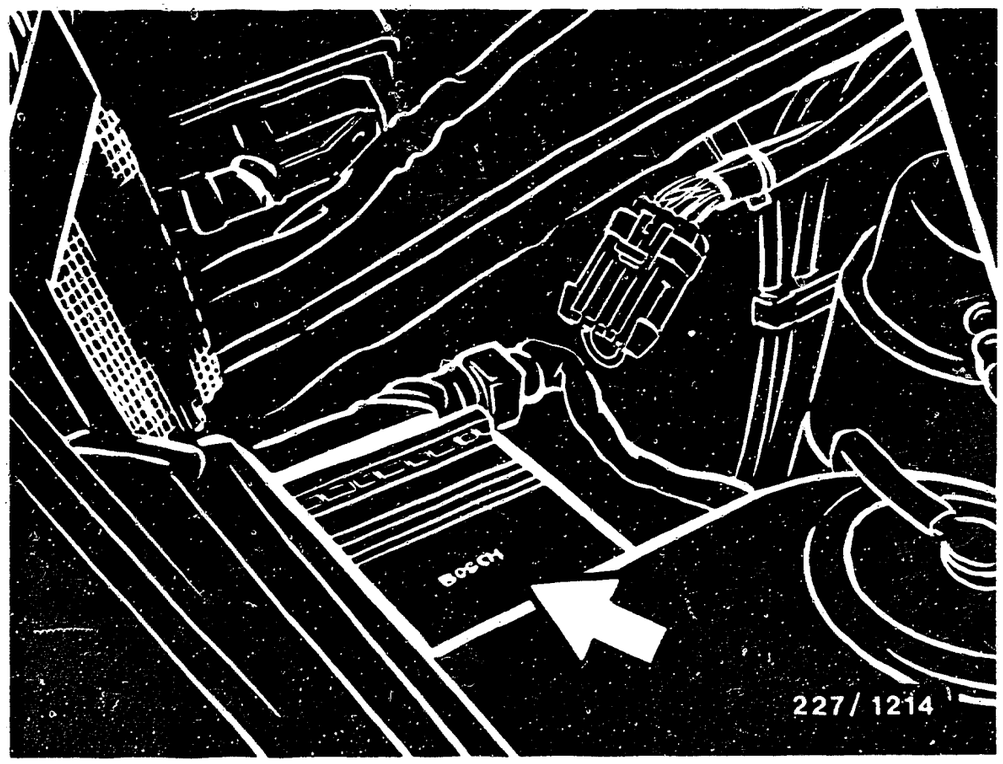


1 = Control unit for centralized locking system
2 = LE-Jetronic control unit

INSTALLATION POSITION OF COMPONENTS (CONTINUED)

The LE-Jetronic control unit is located at the side wall, front right. See picture.

Removal:
Remove side wall (plug connection).



Arrow = Transmission control (TC) - control unit

INSTALLATION POSITION OF COMPONENTS (CONTINUED)

The control unit is located on the right of the engine compartment between spring-strut dome and bulkhead. See picture.

INSTALLATION POSITION OF COMPONENTS (CONTINUED)

* Control relay is located in relay plate (on left of engine compartment).

  Note: Control relay may be fitted in varying sequence in relay plate (feature, black frame).

* Throttle-valve switch with potentiometer is located at throttle-valve assembly.

* Temperature switch (oil) is located at front left of engine (crankshaft pulley).

* Temperature switch (intake manifold) is located at intake manifold, rear.

Trouble-shooting instructions : PEU-5009

BOSCH system : Motronic M 1.3

Make of vehicle : PEUGEOT

Basic microcard : PKW-052

TABLE OF CONTENTS

SPECIAL FEATURES

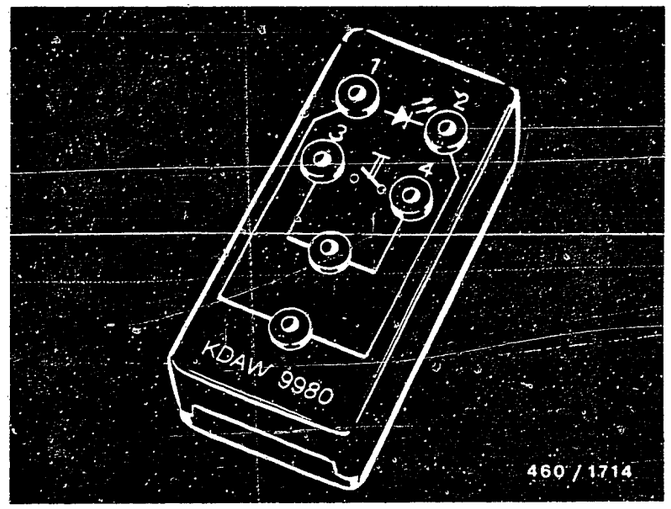
These trouble-shooting instructions, valid at the time of publication, apply to the following vehicle models:

PEUGEOT 405 Mi 16 and
CITROEN BX 19 GTi 16V
with 1.9 l / 4-cyl./16-valve engine 107 kW
Engine type: XU 9 J 4 with catalytic converter as of 3.88

* Motronic M 1.3 with self-diagnosis.
* One sensor for engine speed and reference mark.
* Single-winding rotary actuator.
* External ignition output stage (trigger box)
* Knock control

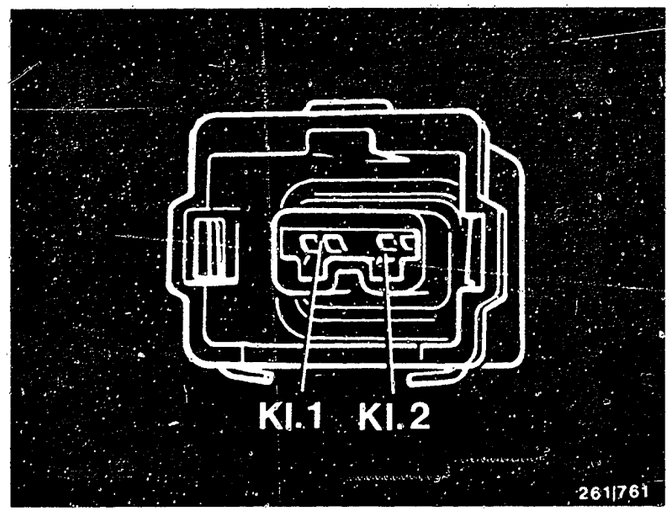
* The self-diagnosis also encompasses actuator diagnosis.
  Actuator diagnosis makes for active testing of outputs of the Motronic control unit and the components connected to it including the connecting leads.
  With these vehicles the following components are activated by the actuator diagnosis:
  1. Injection valves
  2. Idle actuator
  3. Tank ventilation valve
  4. Cut-off relay for A/C compressor (envisaged for later date for A/C)

SPECIAL FEATURES (continued)



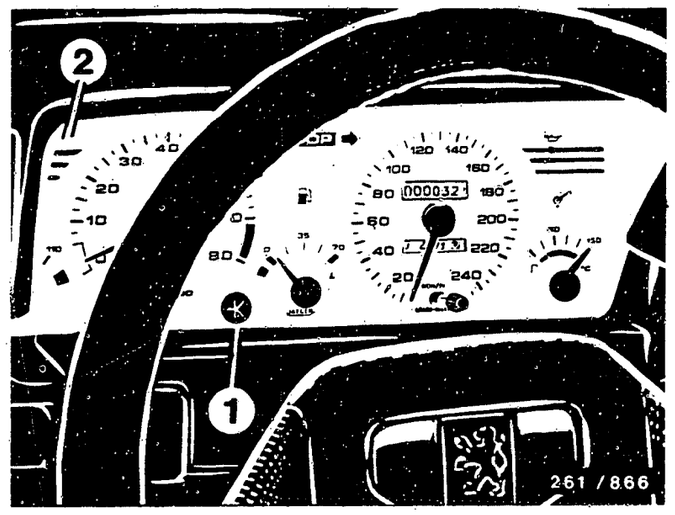
<u>How to use self-diagnosis:</u>
The self-diagnosis and actuator-diagnosis features are activated and evaluated with the evaluation unit KDAW 9980 (top picture).

<u>Connection of evaluation unit KDAW 9980:</u>
Located in the engine compartment in front of the right-hand spring-strut dome is a black plastic box with one or two 2-pole plugs (as well as injection-valve plugs), main relay, pump relay and pump fuse. Generally speaking, only one connection of the grey plug (if provided) is configured (switched positive).
The green plug is the diagnosis test coupling which is assigned as follows (centre picture):
Term. 1: to control unit term. 55 (serial interface for tester diagnosis)
Term. 2: to control unit term. 13 (stimulation input <u>and</u> flashing-code output)



The evaluation unit is connected as follows:

1. Stimulation button:
Connect socket 4 to diagnosis-test-coupling term. 2 and socket 3 to vehicle ground.
2. Fault lamp:
Socket 1 (red) is either to be connected to the switched positive in the grey plug or directly to the positive terminal of the battery. In view of the fact that stimulation and flashing-code output are effected by way of the same lead, sockets 2 (fault lamp actuation) and 4 are connected to one another.
Note:
If there is a fault lamp in the instrument panel (US models feature the so-called "CARB" lamp e.g. with Peugeot as "check-engine" display), fault output can be tracked via this lamp.



See bottom picture (Peugeot):
Item 1 = Fault lamp in European version
Item 2 = Installation position of fault lamp (CARB) in US version

This lamp lights up when the ignition is switched on and goes out again after starting the engine.
If the lamp does not go out after starting the engine or if it lights when the engine is running, there is a fault in the Motronic.

SPECIAL FEATURES (continued)

Activation of self-diagnosis (fault output):

- Switch on ignition [1] (fault lamp comes on)
- Stimulate for between 2.5 and 10 seconds, i.e. press button of evaluation unit (fault output is thus activated and the fault lamp starts to flash)
- The flashing code 1 2 is always output prior to fault output (start of output)
- Stimulate again for between 2.5 and 10 seconds, so as to read out the 1st fault (if applicable) etc. (each flashing code is only output once until renewed stimulation)
- "1 1" appears as "end of output" message when all stored faults have been output (a maximum of 5) or following "1 2" if the fault memory is empty.
- If stimulation is effected again for between 2.5 and 10 seconds following flashing code 1 1, output commences from the beginning with the start code 1 2
- The fault memory is cleared if stimulation is effected for longer than 10 seconds following flashing code 1 2
  Note: the fault memory should be cleared one the causes of the fault on the vehicle have been eliminated

[1] =Engine can also be running ($n < 2000\ min^{-1}$)

SPECIAL FEATURES (continued)

Activation of actuator diagnosis:

- First stimulation process (flashing code 9 1: actuator test of injection valves).
  Start stimulation even before switching on ignition.
  During stimulation process, switch on ignition and terminate stimulation after between 2.5 and 10 seconds. Flashing code 9 1 confirms activation of the injection-valve actuator diagnosis.
  All injection valves should then be audibly clocked.
  Note:
  The valves must be individually actuated in order to establish whether they are all working (detach plugs of other injection valves in each case).

  * Caution! Fuel will be injected into the cylinders if there is any residual fuel pressure. This step should therefore be activated for the shortest possible period.

- Second stimulation process (flashing code 9 2: actuator test of idle actuator).
  Rotary spool of idle actuator is periodically actuated (can be distinctly heard).
- Third stimulation process (flashing code 9 4: actuator test of tank ventilation valve).
  Tank ventilation valve is clocked (can be felt).
- Fourth stimulation process (flashing code 9 3: relay actuator test).
  Cut-out relay for A/C compressor (if provided) switches periodically (can be heard/felt).
- Fifth stimulation process (flashing code 1 1: end of actuator diagnosis).

STRUCTURE AND USAGE

These brief instructions encompass essentially vehicle-specific special features and test specifications (set values).

In accordance with the customer complaint, the trouble-shooting chart leads to different causes/component faults.
For a detailed description of trouble-shooting, see the information in the trouble-shooting chart of the basic instructions.

ATTENTION: Even if reference is made to basic instructions, the set values, terminal assignments and special features of these vehicle-related brief instructions are always binding.

SAFETY AND PRECAUTIONARY MEASURES

In order to keep persons out of danger and to avoid damage to the engine, trigger boxes and control units or to the ignition system, observe the information in the basic instructions.

CAUTION!
High-performance ignition system with dangerous primary and secondary voltages!

Touching voltage-carrying components or terminals may prove fatal (both on the primary and secondary sides).

* Avoid injection of fuel and high-voltage flashovers when testing the compression.
Therefore, disconnect Motronic relay.

TROUBLE-SHOOTING CHART

Customer complaint (fault symptoms)

1. Starting motor operates, engine fails to start or starts only with difficulty.	2. Engine starts but then dies.	3. Idle problems (Engine speed, exhaust gas).	4. Poor throttle take-up, flat spot during acceleration.	5. Engine missing (ignition, injection).	6. Maximum engine power/top speed not reached.	7. Fuel consumption too high.	8. Engine running on (dieseling).	9. Engine pinging/knocking.	10. Engine overheating.	11. Fault lamp.	Cause (component fault)
*	*	*	*	*	*	*	*	*	*	*	Self-diagnosis
*											Voltage at control unit
*											Engine-speed/reference-mark sensor
*		*			*	*					Fuel pressure
					*						Fuel delivery
*		*				*	*				Solenoid-operated injection valves
		*	*								Idle contact
					*						Full-load contact
	*	*	*	*	*	*					Air-flow sensor
	*	*	*								Idle actuator
*	*	*	*								Air-intake system
		*									Idle speed, CO
		*			*						Throttle valve
*		*		*	*						Ignition coil
*		*	*	*	*						Primary signal
		*	*	*	*	*					Secondary pattern
*	*	*	*		*	*		*	*		Ignition point
		*	*	*							Interference-suppression resistors
		*	*	*							Noise test
					*						Interference
		*	*								Lambda closed-loop control
	*	*	*				*				Tank ventilation
					*			*	*		Knock sensor
*				*							Ignition trigger box
*	*	*	*	*	*	*	*	*	*		Control unit

SELF-DIAGNOSIS TEST TABLE

Fault indication Flashing code	Testing of component/function	Test instructions / Test conditions	Term.	Set values
1 2	Control unit/flashing-code output O.K. (Start of output)	Flashing-code output does not function if stimulation lead, fault lamp and leads, plug and power supply to control unit are defective. The control unit is defective if everything is O.K., but no flashing code is output.	13 15	———
1 3	Temperature sensor (Intake air)	Test temperature sensor and lead for short-circuit to ground and open-circuit. Temperature-sensor resistance: at +15°C...+30°C:	44	——— 1450...3300 Ω
1 4	Temperature sensor (Engine)	Test temperature-sensor lead for short-circuit to ground and open-circuit. Temperature-sensor resistance: at +15... +30°C: at approx. +80°C:	45	——— 1450...3300 Ω 280... 360 Ω
1 5 *	Fuel-pump relay and output stage in control unit	Fault: Short-circuit to ground, to battery positive or open-circuit. Resistance of relay winding (term. 85/86):	3	50... 150 Ω
2 1	Throttle-valve switch/ idle contact	Fault: Idle contact permanently closed. Idle contact closed in off position: Actuate throttle valve somewhat:	52	approx. 0 Ω infinity Ω
2 2	Idle actuator	Fault: Short-circuit to ground, to battery positive or open-circuit in actuator winding/lead. Resistance of actuator winding:	4	approx. 8 Ω

* = Self-diagnosis only detects this fault in conjunction with other recognized faults.

SELF-DIAGNOSIS TEST TABLE (CONTINUED)

Fault indication Flashing code	Testing of component/function	Test instructions / Test conditions	Term.	Set values
3 1 3 2	Lambda closed-loop control not optimal (Adjustment by way of adaption still possible)	CO content (ahead of catalytic converter). Test intake system for leaks. Fuel pressure outside tolerance. Injection valves defective (e.g. leakage or covered with deposits). Temperature sensor (engine) or (intake air) outside tolerance. Leak in exhaust system (lambda-sensor signal biased) Lambda sensor defective or contact resistance in lead (including poor ground). Tank ventilation valve defective (e.g. permanently open).	—	—
3 3	Air-flow sensor	Test air-flow-sensor leads for continuity and short-circuits (to ground, to battery voltage and with respect to one another). Watch out for worn cable insulation and loose contacts! Measure resistances of air-flow sensor between term. 2 and term. 4 (change in resistance when sensor flap deflected): between term. 3 and term. 4:	7 12 26	— 8...2500 Ω 300....550 Ω
3 4	Tank ventilation valve and output stage in control unit	Fault: Short-circuit to ground or to battery positive Test lead for contact with ground or battery positive. If O.K., control unit is defective. Winding resistance at +15...+30°C:	5	 35...55 Ω
3 5	Throttle-valve switch/ full-load contact	Fault: Full-load contact permanently closed. Fault lamp (if fitted) may light up occasionally during overrun. Full-load contact closed in full-throttle position: Release accelerator pedal somewhat:	53	 approx. 0 Ω infinity Ω

SELF-DIAGNOSIS TEST TABLE (CONTINUED)

Fault indication Flashing code	Testing of component/function	Test instructions / Test conditions	Term.	Set values
4 2	Injection valves and injection output stage(s) in control unit	Possible faults: 1. Short-circuit to ground or battery positive, or open-circuit in one or both actuation leads (term. 16/17) 2. Joint test lead (for both valve groups) shorted to ground or open-circuit. 3. Control unit and/or injection valves defective.	16 17	7... 9 Ω (2 valves in parallel) 14...17 Ω (1 injection valve)
4 3	Knock control stop (maximum ignition-angle retard was reached several times)	Possible faults: 1. Poor grade of fuel. 2. Engine overheating. 3. Ignition angle too far advanced (e.g. due to incorrect reference-mark detection). Ignition angle when idling: 4. Temperature sensor (air) outside tolerance Temperature-sensor internal resistance at +15...+30°C:	—	 3 ± 5 °CS 1450...3300 Ω
4 4	Knock sensor	Knock sensor or lead (including ground) defective. Internal resistance of sensor: Tightening torque of sensor (loosen screw beforehand when checking):	11	 greater than 1 M Ω 15...25 Nm
5 1	Lambda sensor	Open-circuit or short-circuit to ground/battery positive in lead or lambda sensor. Watch out for worn cable insulation! Sensor heater defective. Sensor clogged.	28	—
5 2	Lambda closed-loop control on rich or lean stop (adaption also on stop)	CO content (ahead of catalytic converter): Major leak in intake system. Test fuel pressure: Injection valves defective.	—	0,7 ± 0,3 vol.% 2,8...3,2 bar

SELF-DIAGNOSIS TEST TABLE (CONTINUED)

Fault indication Flashing code	Testing of component/function	Test instructions / Test conditions	Term.	Set values
5 3	Supply voltage for control unit too low or too high	Test voltage dips at positive and ground terminal. Charge battery, test alternator system. Supply voltage:	18 19 (+) (−)	10...16 V
5 4	Control unit/digital section (including evaluation circuit for knock control)	Control unit defective	—— (+) (−)	——
1 1	End of output			

* Pressure regulator

Fuel pressure:	2,8... 3,2 bar

* Electric fuel pump

Delivery (measured in return line):	min. 750 cm ^{3} /30s
Supply voltage (under load):	min. 12 V

* Temperature sensor (air)

Internal resistance measured at air-flow sensor between term.5 and term.4 at ambient temperature (+15°C...+30°C):	1450...3300 Ω

* Temperature sensor (engine)
(Plug colour blue)

Internal resistance at ambient temperature (+ 15° C...+ 30° C):	1450...3300 Ω
with engine at operating temp. (approx. + 80° C):	280... 360 Ω

* Knock sensor

Internal resistance	greater than 1 M Ω
Tightening torque:	15...25 Nm

(loosen screw first when checking)

* Air-flow sensor

Internal resistance at	
Term.2 and term.4 :	8...2500 Ω (1)
Term.3 and term.4 :	300... 550 Ω

(1) Slowly deflect sensor flap as far as it will go. Resistance fluctuates between the potentiometer terminals.

* Engine-speed/ reference-mark sensor

Electrical internal resistance at ambient temperature (+15°C...+30°C):	400...800 Ω
Air gap:	0,8±0,5 mm

* Throttle-valve switch

Resistance value of idle contact (term. 1 and term. 2):	Approx. 0 Ω
Resistance value of full-load contact (term. 1 and term. 3):	Approx. 0 Ω

* Solenoid-operated injection valve

Internal electrical resistance at ambient tempeature (+ 15° C...+ 30° C):	15...17,5 Ω

* Trigger box (output stage)

Supply voltage at term. 4 and term. 2 : (with engine at idle):	12...14 V, max. 1 V less than battery voltage
Supply voltage at term. 4 and term. 2 : (with ignition ON)	Battery voltage
Control signal at term. 5 and term. 2 :	Rectangular pulses

* Idle actuator

Electrical internal resistance at +15°...+30°C :	Approx. 8 Ω

* Ignition coil

Primary resistance:	0,5... 0,9 Ω
Secondary resistance:	6,6...12,1 k Ω

TEST SPECIFICATIONS (continued)

* Idle test

Engine at operating temperature, switch off loads.
Idle speed: 880 ± 50 min $^{-1}$

Ignition angle: 3 ± 5 °CS

Note:
If TDC sensor installed (3-pole connector), make use of diagnosis lead 1 684 465 188 for measuring ignition angle.

* CO content

ahead of catalytic converter (if sampling point provided): 0,7 ± 0,3 vol.% CO

downstream of cat. convert. (tailpipe) approx. 0 vol.% CO

* Lambda sensor

Heater-winding resistance: 1...15 Ω

* Tank ventilation valve

Internal resistance at +15°C...+30°C: 35...55 Ω

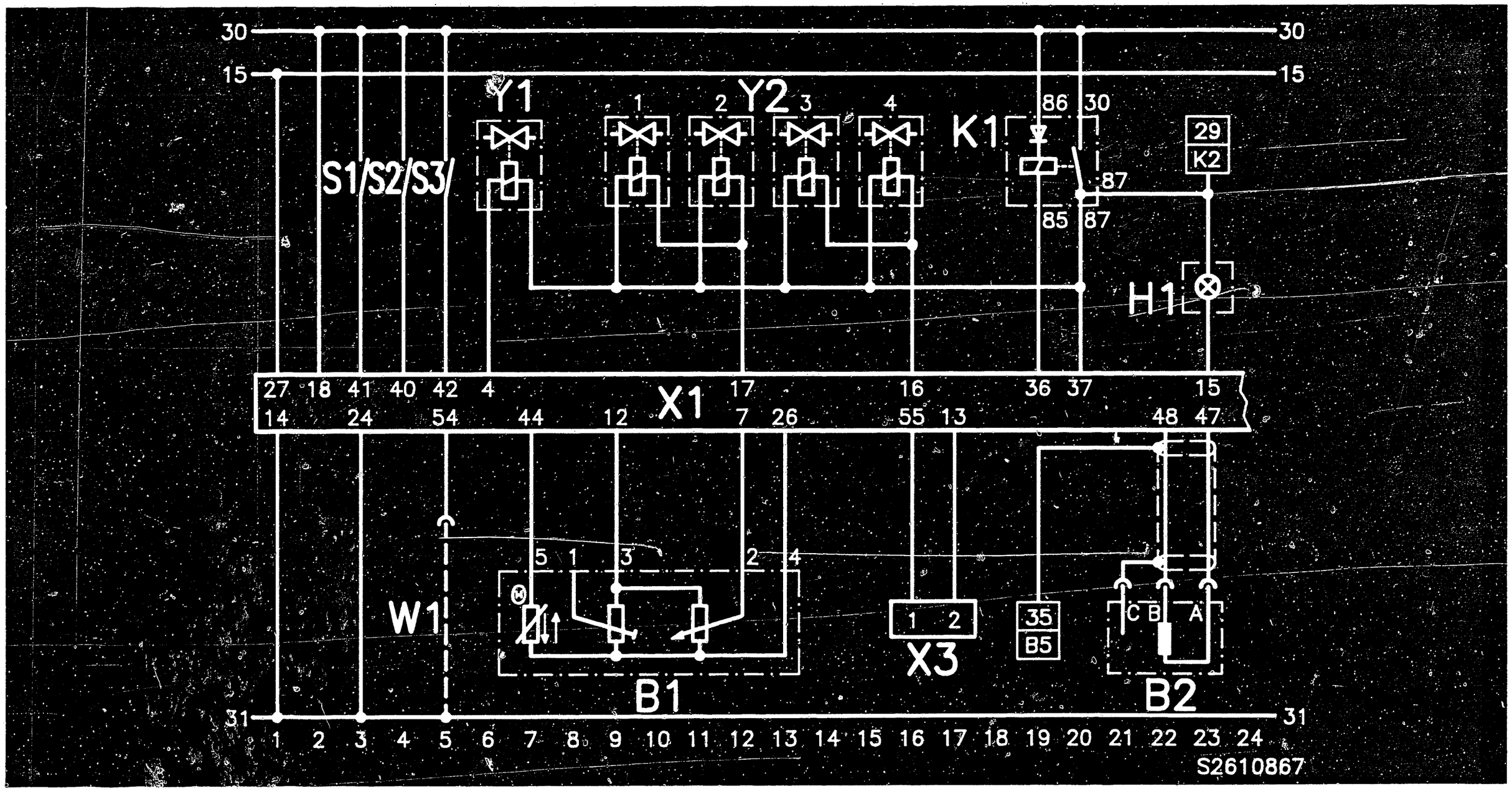
* Interf.-suppression resistors

High-tension distributor rotor: 1 k Ω

The secondary side of the ignition system must be provided with interference suppression of at least 5 k Ω overall resistance. High-voltage resistance leads are fitted as standard.

Please refer to equipment and Autodata microcard for settings as regards valve clearance and other engine-related data.

For production reasons:
continued on the following coordinate.

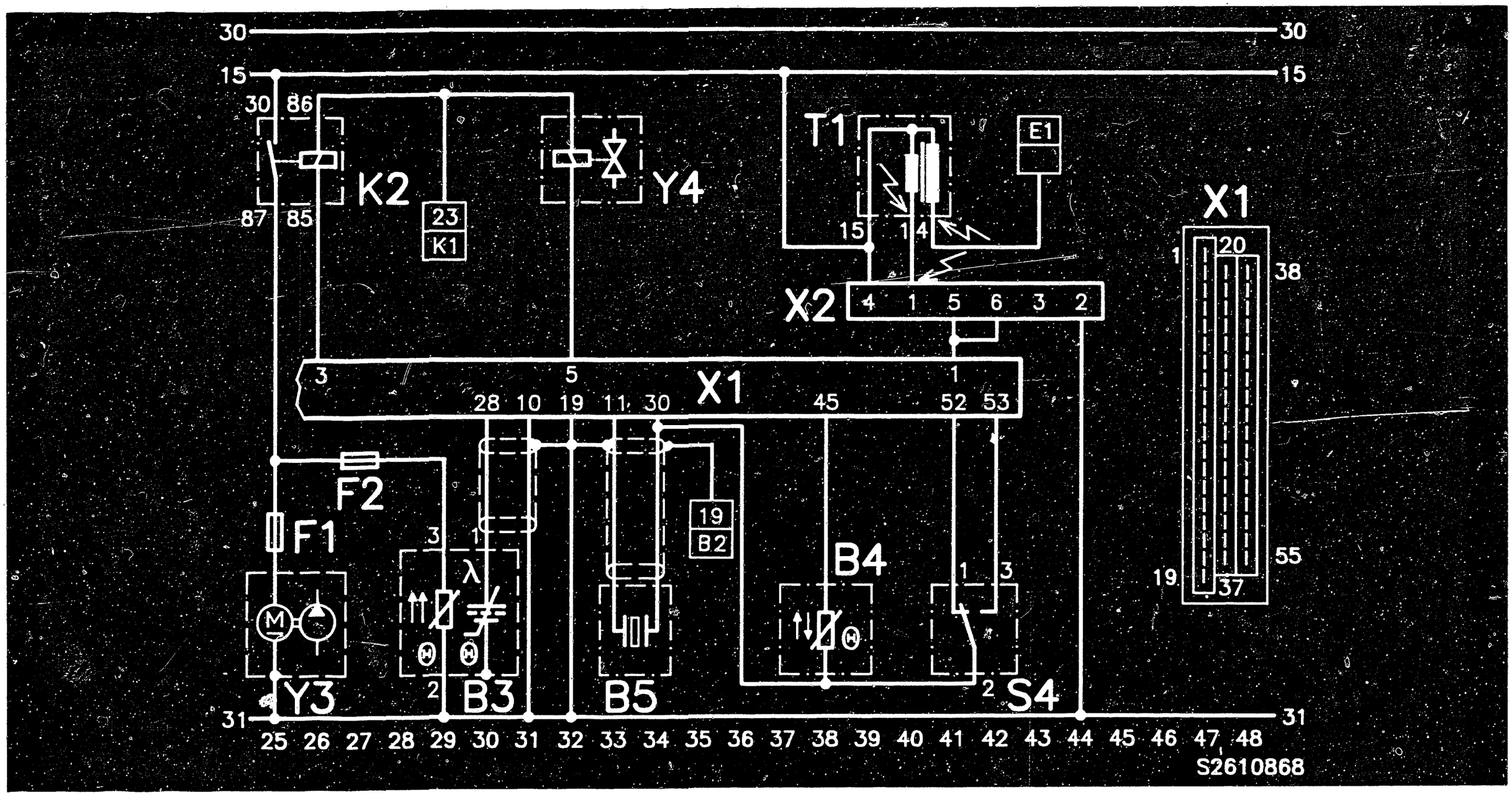


B1 = Air-flow sensor
B2 = Engine-speed/reference-mark sensor
H1 = Fault lamp ("CARB lamp")
K1 = Main relay
K2 = Pump relay
S1 = A/C readiness switch
(if A/C provided)
S2 = A/C compressor switch
(if A/C provided)
S3 = Switch, driving-position switch (if automatic)
W1 = Coding for ignition map (95/91 RON; EU)
X1 = Motronic control-unit plug
X3 = Diagnosis test coupling
Y1 = Idle actuator
Y2 = Solenoid-operated injection valves

ELECTRICAL TERMINAL DIAGRAM

G21 — ⟹

G22 — ⟺

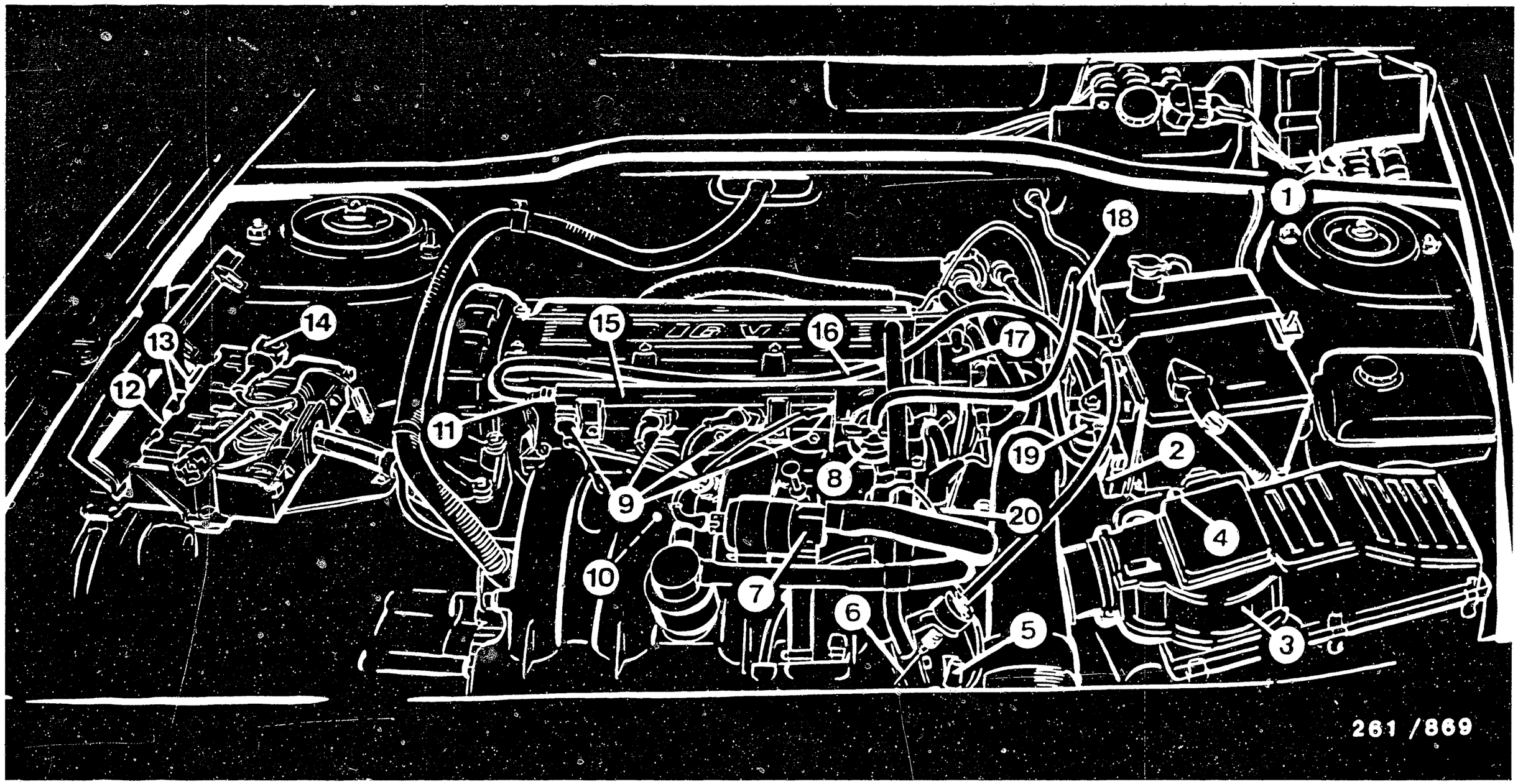


B3 = Heated lambda sensor
B4 = Temperature sensor (coolant)
B5 = Knock sensor
E1 = High-tension distributor
F1 = Pump fuse
F2 = Fuse for sensor heater
K1 = Main relay
K2 = Pump relay
S4 = Throttle-valve switch
T1 = Ignition coil
X1 = Motronic control-unit plug
X2 = Ignition-trigger-box plug
Y3 = Electric fuel pump
Y4 = Tank ventilation valve

ELECTRICAL TERMINAL DIAGRAM (CONTINUED)

G23 — <⟹>

G24 — <⟸



1= Motronic control unit
2= Ignition trigger box
3= Air-flow sensor
4= CO potentiometer
5= Throttle-valve stop screw
6= Accelerator
7= Idle actuator
8= Pressure regulator
9= Injection valves
10= Knock sensor
11= Pressure-gauge connection
12= Pump fuse
13= Main and pump relay
14= Diagnosis test coupling
15= Fuel-distribution pipe
16= Fuel inlet hose
17= High-tension distributor
18= Fuel return hose
19= Fuel pressure damper
20= Ignition coil

INSTALLATION POSITION OF COMPONENTS (Peugeot)

G25 —— ==> | G26 —— <==>

INSTALLATION POSITION OF COMPONENTS (continued)

The installation locations always refer to the direction of travel.

* Electric fuel pump and fuel filter:
  Beneath vehicle between fuel tank and rear axle.
  Otherwise pump in tank in the event of in-tank electric fuel pump (access via cover beneath rear seat bench)

* Lambda sensor:
  Screwed into exhaust system ahead of catalytic converter (picture top left, arrow).

* Plug connection to lambda sensor:
  Beneath vehicle.
  Picture top right:
  Item 1 = Sensor signal
  Item 2 = Sensor heater (white leads)

* Tank ventilation valve:
  Ahead of engine (centre picture, arrow).

* Active-carbon container:
  Beneath vehicle, ahead of left-hand front wheel house (bottom picture, arrow).

* Fuse box (Peugeot):
  In instrument panel, bottom left.
  Top of fuse box can be swivelled out.

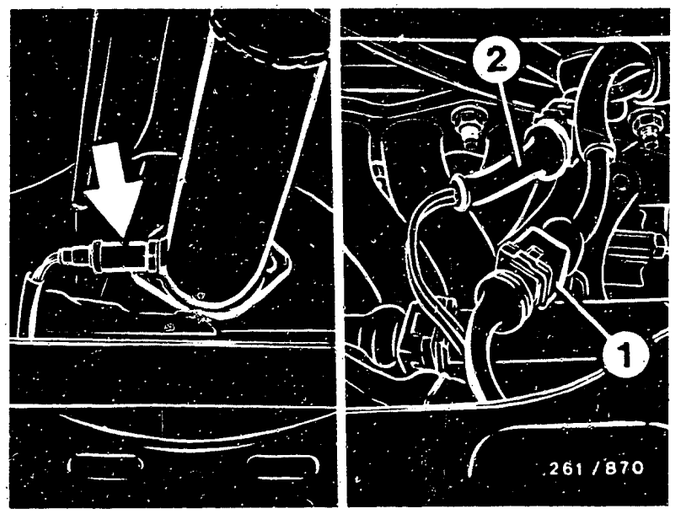
* Temperature sensor (intake air):
  In air-flow sensor.

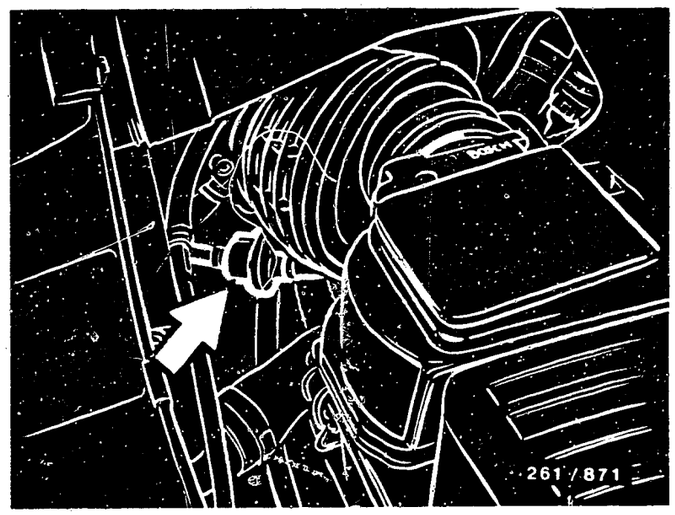
* Engine-speed/reference-mark sensor:
  On left in engine block, beneath high-tension distributor.

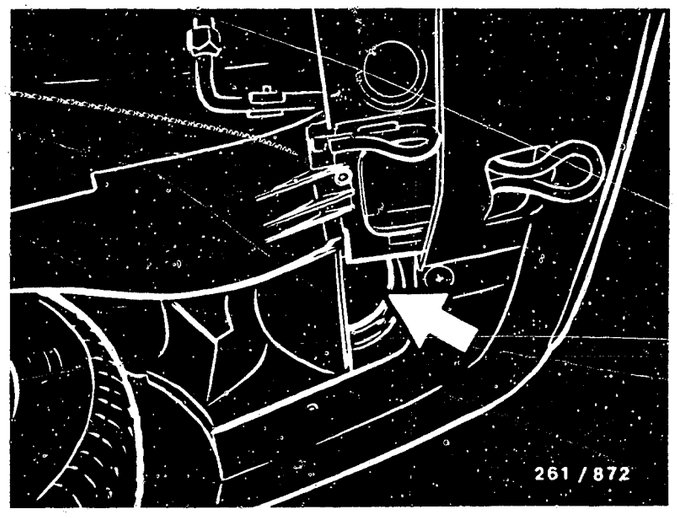
* Temperature sensor (engine):
  Screwed into engine block, in vicinity of engine-speed/reference-mark sensor.

* Throttle-valve switch:
  On side of throttle-valve assembly.

* Auxiliary-air device:
  In bypass to throttle valve.







T A B L E O F C O N T E N T S

Trouble-shooting instructions : BMW-530

BOSCH System : Motronic

Vehicle make : BMW

Basic microcard : BMW-512,BMW-514

SPECIAL FEATURES

This microcard contains the Motronic trouble-shooting instructions for the following models valid at the time of writing:

BMW 325e, 525e;
with catalytic converter and lambda closed-loop control; as of 12.84 - 2.7 l / 6-cyl. engine

Countries of application: Germany

RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER

The following rapid diagnosis chart makes it possible for the Motronic specialist to quickly test the electrical part of the system using the universal test adapter. If detailed information and instructions are necessary, the similar microcards BMW-512 and BMW-514 can be used
as aids.

The rapid diagnosis chart contains the following information:

* Test-step sequence.
* Position of the V- and Ω -program switch.
* Remarks on the operation of the universal test adapter and other components.
* Test specifications for motortester and multimeter.

Note:

For vehicles with lambda closed-loop control, adapter cable 1 684 463 124 (instead of .. 128) can also be used; however, this requires that the lambda test steps be tested as well (see test steps 44a, 45a, 46a).

RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER

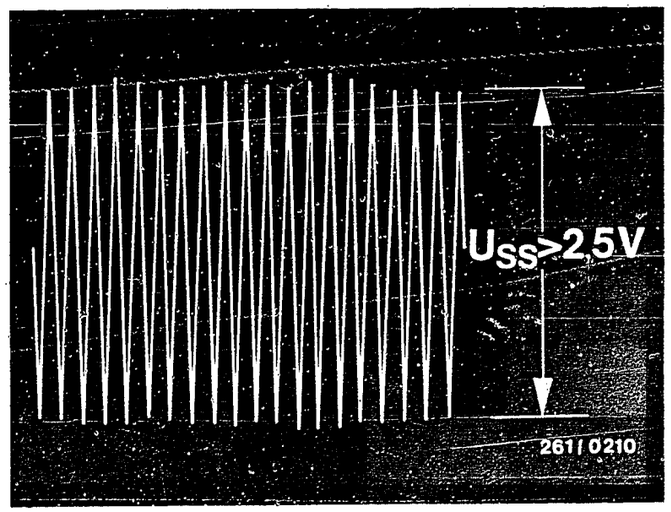
Test step	Switch position V	Switch position Ω	Measurement and remarks	Measurement at control-unit plug between terminals	Test specifications (reading)
1	V	1	Disengage gear. Ignition off. Unplug control unit and pump fuse. Insulation resistance of engine-speed sensor.	8 <⟹> 5	greater than 1 M Ω
2	V	2	Insulation resistance of reference-mark sensor.	25 <⟹> 5	greater than 1 M Ω
3	V	3	Winding resistance of engine-speed sensor.	8 <⟹> 27	0,6...1,6 k Ω
4	V	4	Winding resistance of reference-mark sensor.	25 <⟹> 26	0,6...1,6 k Ω
5	V	5	Resistance of temperature sensor, engine (NTC II) Resistance is temperature-dependent.	13 <⟹> 5	(+15...+30°C): 1,3...3,6 k Ω (approx. +80°C): 250...390 Ω
6	V	6	Resistance of temperature sensor, air (NTC I.) Resistance is temperature-dependent.	22 <⟹> 5	(+15...+30°C): 1,3...3,6 k Ω
7	V	7	Resistance of characteristic-map switch.	10 <⟹> 5	325e: less than 10 Ω 525e: infinite Ω
8	V	8	Not applicable		
9	V	9	Throttle-valve switch. Resistance of idle contact. Accelerator pedal at rest: Throttle plate open slightly:	2 <⟹> 5	 less than 10 Ω greater than 1 M Ω
10	V	10	Resistance of full-load contact. Fully depress accelerator pedal.	3 <⟹> 5	less than 10 Ω
11	V	11	Resistance of ground lead.	16 <⟹> 5	less than 10 Ω

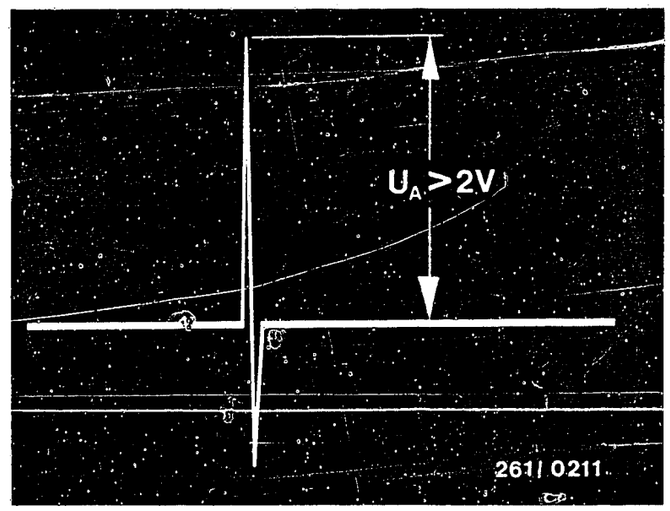
H03 — <⟹>

H04 — <⟹>

Rapid diagnosis chart for universal test adapter (continued)

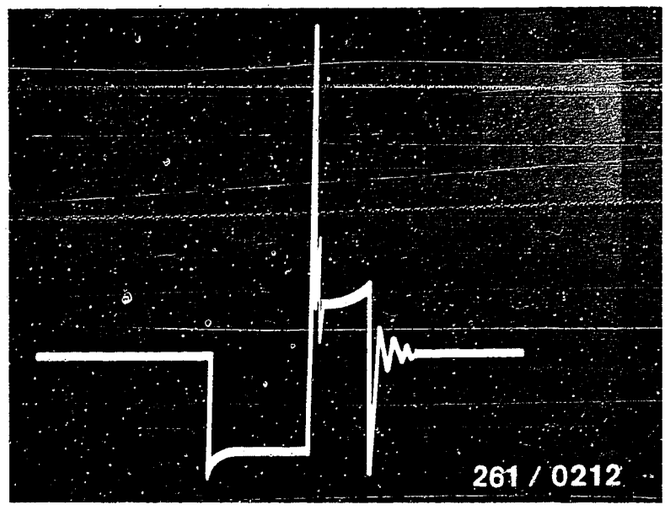
Test step	Switch position V	Switch position Ω	Measurement and remarks	Measurement at control-unit plug between term.	Test specifications (readings)
12	| V	12	Resistance of ground lead	17 <⟹> 5	less than 10 Ω
13	| V	13	Resistance of ground lead	19 <⟹> 5	less than 10 Ω
14	| V	14	Resistance of altitude sensor (pressure sensor)	30 <⟹> 5	0,4...2,3 k Ω (altitude-dependent)
15	| V	14	Careful! Voltage measurement at ohm sockets (Altitude sensor; upper ill -2) Ignition on. In case of negative display, switch polarity. Test values depend on altitude and battery voltage. U_B = 10...14 V	30 <⟹> 5	0m: 1,5...3,5 V 500m: 2,5...5 V 1000m: 3,5...6 V 1500m: 4,5...7,5 V
16	1	15	Test engine-speed sensor signal with oscilloscope (middle ill.) Disengage gear and start.	8 <⟹> 27	See upper illustration
17	2	15	Test reference-mark sensor signal with oscilloscope (lower illustration). Disengage gear and start.	25 <⟹> 26	See lower illustration
18/19	3/4	15	Not applicable		





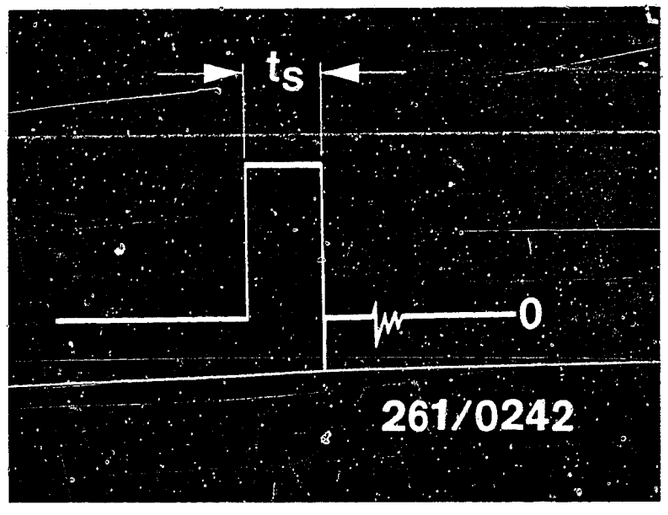
Rapid diagnosis chart for universal test adapter (continued)

Test step	Switch position V	Switch position Ω	Measurement and remarks	Measurements at control-unit plug between term.	Test specifications (reading)
20	6	15	Main-relay voltage. Switch on ignition.	35 <⟹> 5	10...15 V
21	7	15	Main-voltage relay.	18 <⟹> 5	10...15 V
22	5	15	Test ignition signal with oscilloscope. (Control unit, connect ignition output stage from control unit with the ignition switched off, and start engine)	1 <⟹> 5	Signal present (see upper illustration)
23	8	15	Voltage supply for air-flow sensor.	9 <⟹> 5	greater than 8 V
24	9	15	Slider voltage from potentiometer in air-flow sensor. Ignition on. Sensor flap at rest : Sensor flap completely open:	7 <⟹> 5	 150...250 mV greater than 7 V
25/26	10/11	15	Not applicable		
27	12	15	Starting signal from term.50 Disengage gear and start.	4 <⟹> 5	8...15 V
28	13	15	Test dwell-period signal from control unit with oscilloscope. Disengage gear and start.	21 <⟹> 5	Signal present (see lower illustration)



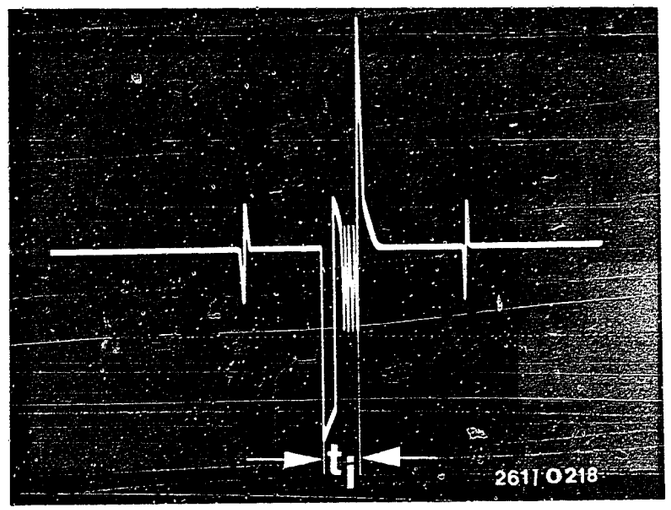
Ignition signal

Dwell-period signal
t_s = dwell period



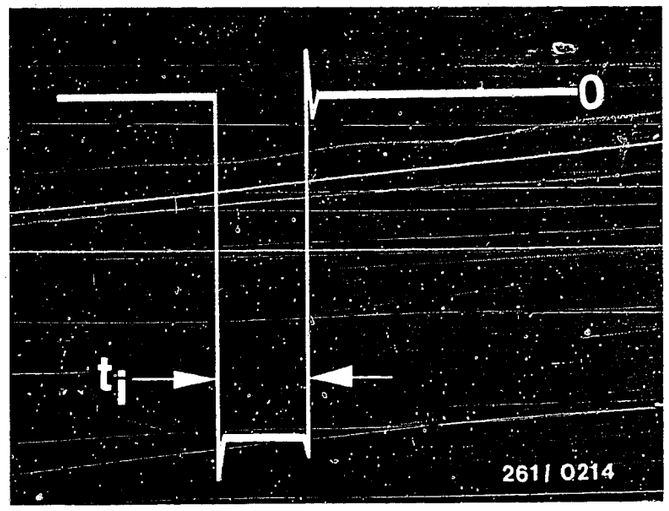
Rapid diagnosis chart for universal test adapter (continued)

Test step	Switch position V	Switch position Ω	Measurement and remarks	Measurements at control-unit plug between term.	Test specifications (reading)
29	14	15	Test injection signal from control unit with oscilloscope. Disengage gear and start.	14 ⟺ 5	Signal present (see upper illustration)
30	14	15	As 29, except after pressing button T1 (NTC II, cold) the injection duration becomes somewhat longer. Press button for only about 2 seconds.	14 ⟺ 5	See upper ill.; t_i becomes somewhat wider.
31	15	15	As test step 29, except 2nd output for solenoid-operated injection valves	15 ⟺ 5	Signal present (see upper illustration)
32	16	15	Test injection signal (measurement output, control unit) using oscilloscope. Disengage gear and start.	11 ⟺ 5	Signal present (see lower illustration)
33	17	15	Voltage at pump relay. Plug in pump fuse. Ignition on.	20 ⟺ 5	10...15 V
34	17	15	Voltage at pump relay. Test of pump control in control unit. Disengage gear and start.	20 ⟺ 5	max. 4 V
35	17	15	Fuel-pressure test: Ignition off. Connect pressure gauge to test connection. Ignition on. Press button T3.	20 to ground	2,3...2,7 bar



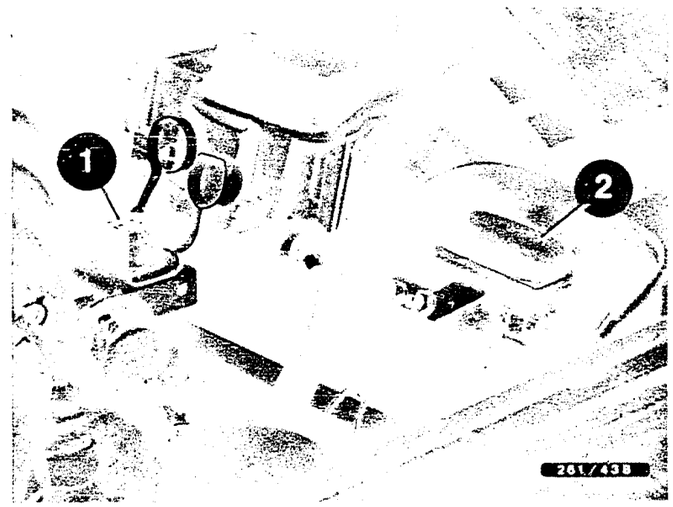
Injection signal
t_i = duration of injection

t_i = Duration of injection



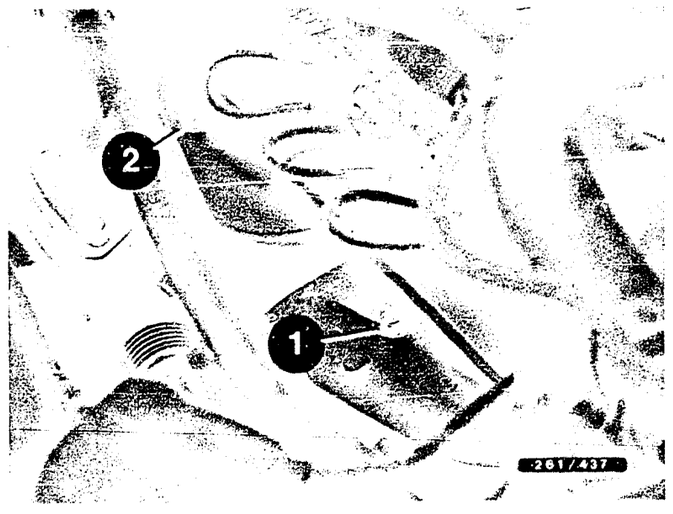
Rapid diagnosis chart for universal test adapter (continued)

Test step	Switch position V	Switch position Ω	Measurement and remarks	Measurements at control-unit plug between term.	Test specifications (reading)
36	17	15	Test CO and idle speed: Connect motortester and (1 684 463 122) diagnostic cable Connect CO-tester to test connection before catalytic converter (if possible, join the two CO-sampling points, for example with the BMW exhaust-gas pickup/adapter). When testing with adapter cable 1 684 463 124 disconnect the plug connection of the lambda sensor Carry out CO measurement first. Engine at operating temp. Consuming devices switched off. Carry out adjustment work quickly.	———	0,2...1,2 vol%CO 650...750 min $^{-1}$
37	17	15	Test spark advance at idle speed: run engine at operating temperature and idle speed (650...750 min $^{-1}$). Engine speed must be correct, as otherwise the incorrect spark advance will be indicated.	———	4°...14° at idle speed
38	17	15	Test spark adv. at full load: Engine at operating temp. Set engine speed to 2700 min $^{-1}$. Press button T6.	3 to ground	7°...17° at 2700 min $^{-1}$
39	17	15	Dwell angle at idle speed: Dwell angle at 2700 min $^{-1}$:	——— ———	6°...18° 22°...42°



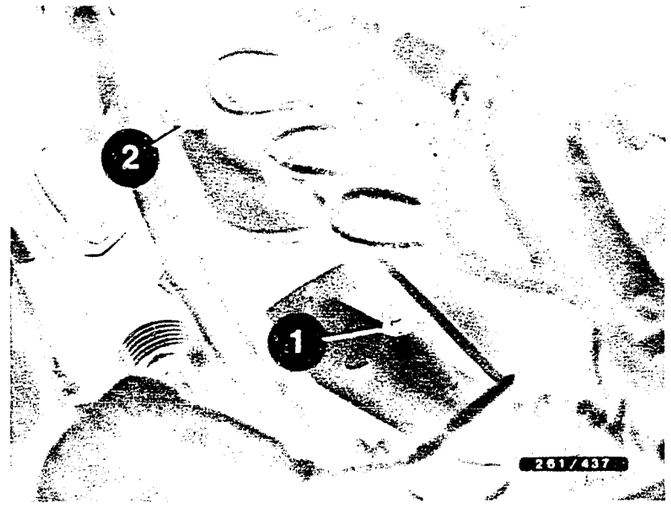
1 = Diagnostic connection
2 = Altitude sensor

CO-connections before cat. converter
1 = cylinders 1 + 2 + 3
2 = cylinders 4 + 5 + 6



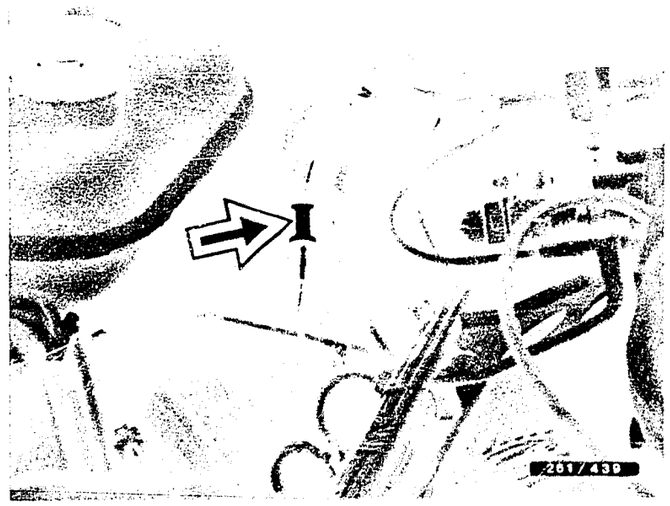
Rapid diagnosis chart for universal test adapter (continued)

Test step	Switch position V	Switch position Ω	Measurement and remarks	Measurements at control-unit plug between term.	Test specifications (reading)
40	17	15	Test overrun cut-off: maintain engine speed at constant 2000 min $^{-1}$ .Press button T5. Injection signals discontinue and then come back on at about 1000 min $^{-1}$, etc.	2 to ground	Engine "surges"
41/42	18/ 19	15	Not applicable		
43	20	15	Only 325e: Test actuation of sensor-heating relay. Operate engine at idle speed.	31 <⟹> 5	max. 4 V
Testing of lambda closed-loop control can be carried out as follows: 1. With adapter cable 1 684 463 128 see test steps 44, 45, 46 2. Without test adapter, if only the adapter cable 1 684 463 124 is available, see test steps 44a, 45a, 46a With both test methods, connect the CO-tester before the catalytic converter and run the engine at idle speed and normal operating temperature.					
44	20	22	Testing with adapter cable 1 684 463 128: test of lambda closedloop control upper limit. Test adapter connects term.24 from control unit to ground. This test step must be kept brief in order to prevent damage to the catalytic converter.	24 to ground	CO rises above 1,2 vol.%CO (After approx. 10 sec., the control unit switches to open-loop control and the CO drops off)
45	20	23	As test step 44, except test of lambda closed-loop control lower limit. Test adapter applies +2 V to term. 24 of control unit	24 to +2 V	CO falls below 0,2 vol.%CO Uneven engine idling



CO-connections before cat. converter
1 = cylinders 1 + 2 + 3
2 = cylinders 4 + 5 + 6

Arrow = Lambda-sensor plug connection

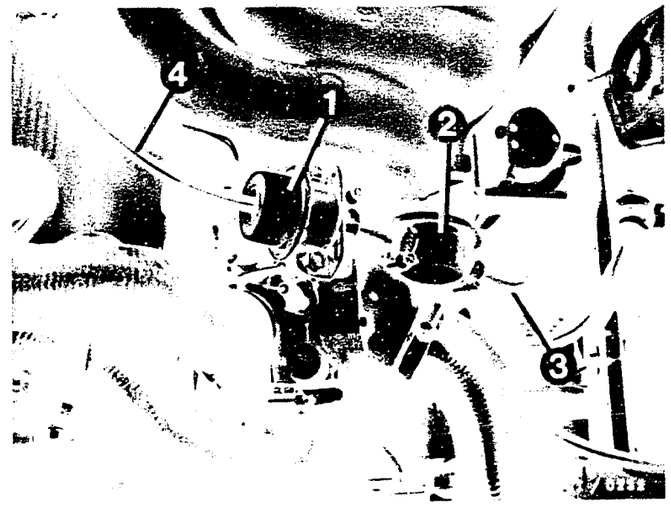


Rapid diagnosis chart for universal test adapter (continued)

Test step	Switch position V	Switch position Ω	Measurement and remarks	Measurements at control-unit plug between term.	Test specifications (reading)
46	20	24	Test of lambda sensor in closed-loop operation. Test adapter connects control-unit term. 24 to lambda sensor.	24 connected to lambda sensor.	0,2...1,2 vol.%CO
			As above, except pull air hose from pressure regulator and seal off. Immediately observe CO reading.		CO value rises briefly and then falls back to above closed-loop control value.

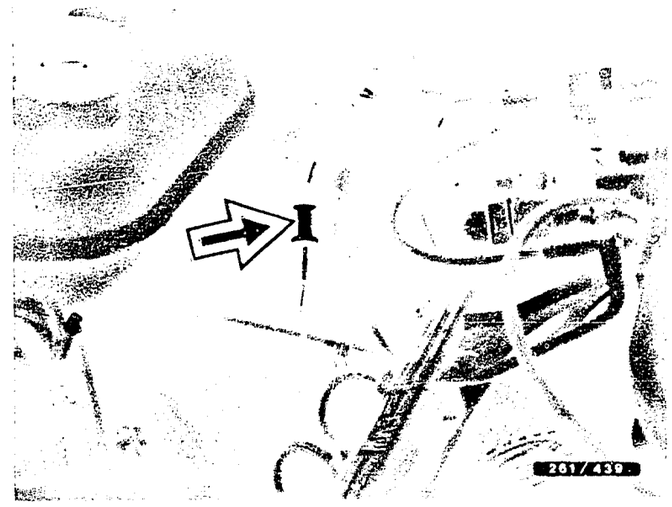
Testing of lambda closed-loop control without test adapter

44a	Test of lambda closed-loop control upper limit. Separate plug connection of lambda sensor and connect lead going to control unit (term. 24) to ground. Keep this test step brief to prevent damage to the catalytic converter. (After 10 seconds, the control unit switches to open-loop control, and the CO drops off.)	CO rises above 1,2 vol.%
45a	Test of lambda closed-loop control lower limit. Disconnected lead to control unit (term.24) must be connected to voltage of approx. +2 V (e.g. 1,5 V singlecell battery, positive to term. 24, negative to vehicle ground).	CO falls below 0,2 vol.% Uneven engine idling
47a	Test of lambda sensor in closed-loop operation. Re-connect lambda-sensor plug connection.	0,2...1,2 vol.%CO
	As above, except disconnect air hose from pressure regulator and seal off. Immediately observe CO reading.	CO value rises briefly and then falls back to above closed-loop control value.



1 = Pressure regulator
2 = Fuel-line-pressure damper
3 = Fuel return line
4 = Air hose to intake manifold

Arrow = Lambda-sensor plug connection

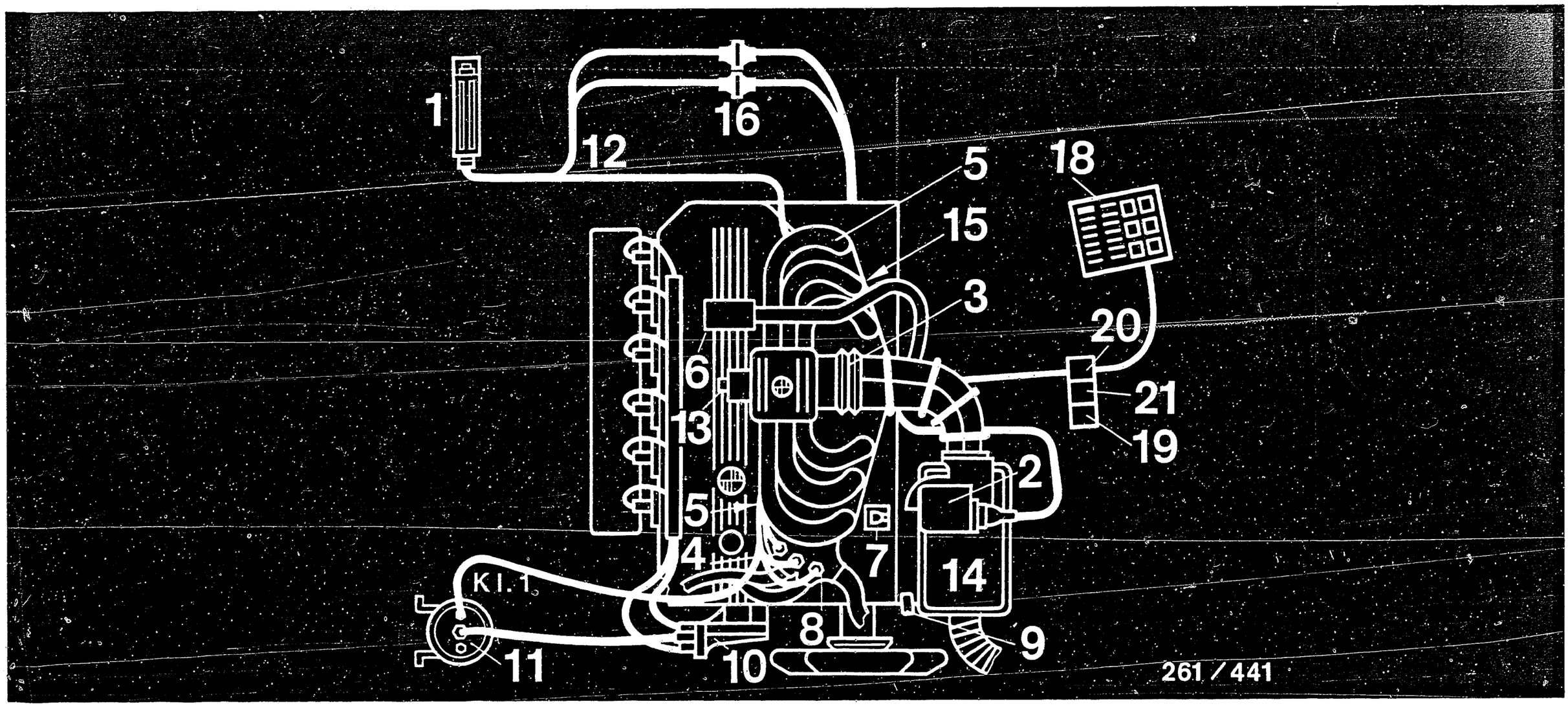


TEST SPECIFICATIONS

Idle speed	650...750 min $^{-1}$
Exhaust-gas setting	
CO value with engine at operating temperature and lambda sensor disconnected:	0,2...1,2 vol. %
Pressure regulator	
Fuel pressure	2,3...2,7 bar
Electric fuel pump	
Delivery quantity (measured in return line)	min. 750 cm ^{3} /30s
Pre-supply pump:	approx. 825 cm ^{3} /30s
Connection voltage (under load):	min. 12 V
Temperature sensor II (NTC II engine)	
Electrical internal resistance:	
At ambient temperature (+15°C...+30°C):	1,3...3,6 k Ω
Engine at operating temperature (approx. +80°C):	250...390 Ω
Solenoid-operated fuel-injection valveil	
Electrical internal resistance:	
At ambient temperature (+15°C...+30°C)	2...3 Ω
Start valve	
Electrical internal resistance	approx. 4 Ω

Test specifications (continued)

Air-flow sensor	
Electrical internal resistance between terms.7 and 6:	8...2500 Ω *
terms.9 and 6:	500...1100 Ω
(* Deflect sensor flap all the way to stop).	
Temperature sensor I (NTC I air)	
Electrical internal resistance measured at air-flow sensor between terms.22 and 6 at ambient temperature (+15°C...+30°C):	1300...3600 Ω
Engine-speed and reference-mark sensors	
Electrical internal resistance at ambient temperature (+15°C...+30°C):	600...1600 Ω
Idle actuator (non-BOSCH product)	
Electrical internal resistance at ambient temperature (+15°C...+30°C):	approx. 9...10 Ω
Lambda sensor	
Resistance of heating winding (325e):	1...15 Ω
Altitude sensor	
Total resistance between term.3 (+) and term.2(-):	2,3...2,5 k Ω
Resistance between wiper term.1(s) and term.2 (-):	0,4...2,3 k Ω (altitude-dependent)



INSTALLATION POSITION OF COMPONENTS

1 = Control unit
2 = Air-flow sensor
3 = Throttle-valve switch
4 = Temperature sensor, engine
5 = Fuel-injection valves
6 = Idle actuator
7 = Diagnostic socket
8 = Thermo-time switch
9 = Altitude sensor
10 = High-voltage distributor
11 = Ignition coil
12 = Wiring harness
13 = Start valve
14 = Air filter
15 = Central ground
16 = Plug connections for engine-speed and reference-mark sensors
17 = Pump fuse
18 = Electrics console
19 = Main relay
20 = Pump relay
21 = Relay for sensor heating (325e only)

Installation position of components (continued)

Installation position is always given relative to the direction of travel.
Components that are not visible in the illustration are listed below.

* Reference-mark and engine-speed sensors:
In starting-motor ring-gear housing on circumference of flywheel ring gear.

* Fuel filter:
In engine compartment on left, near the firewall.

* Fuel pump:
Underneath the vehicle on the left, near the fuel tank.

* Electric fuel pump ground lead:
Underneath the rear seat on the left (depression), with ground point on body.

* Control unit:
In the glove compartment behind covering.

* Temperature sensor I (air):
In the air-flow sensor.

* Central ground:
On intake tube of cylinder 5.

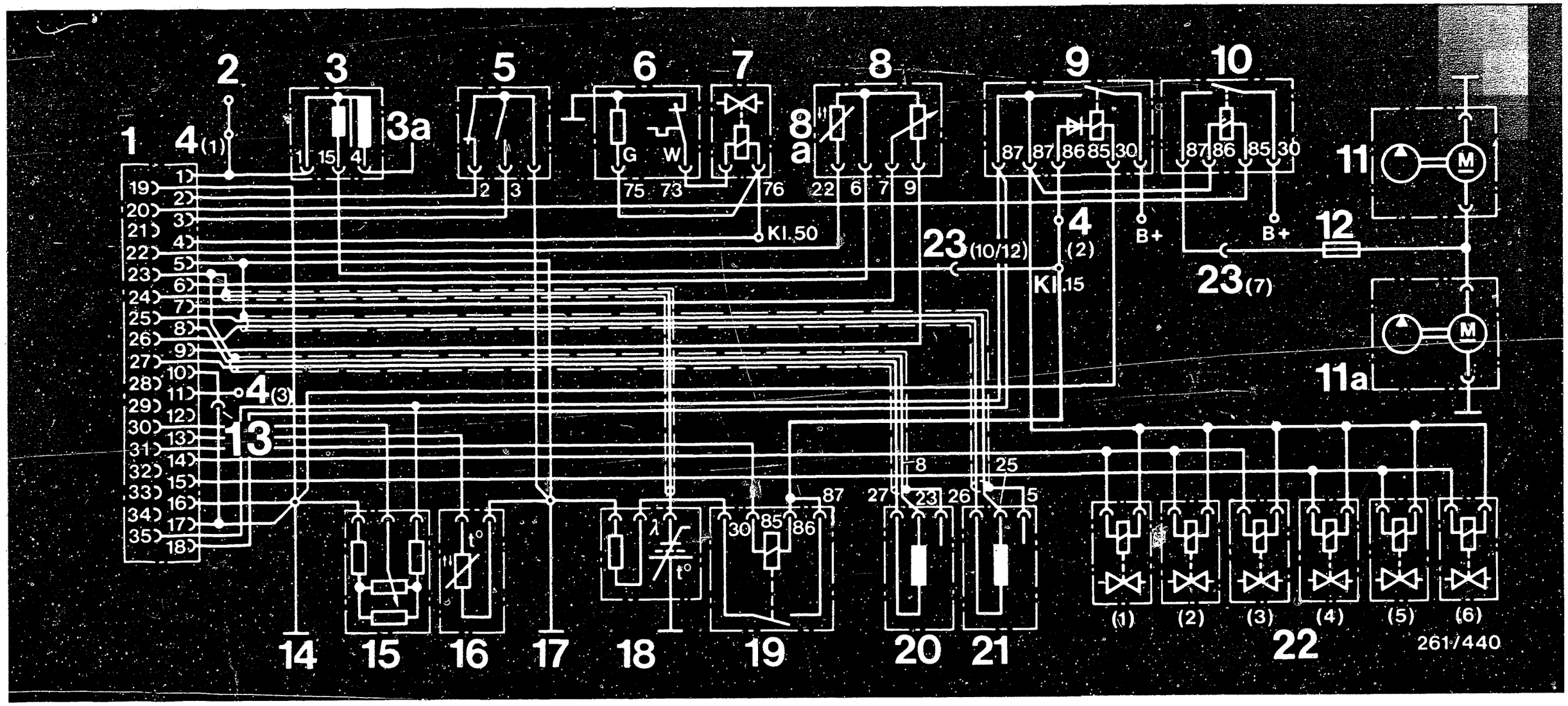
* Throttle-valve switch:
On bottom of throttle-valve assembly.

* Pressure regulator:
Near the plugs to the termo-time switch and engine-temperature sensor.

H21 — <==

For production reasons:
continued on the following coordinate.

H22 — => <=



ELECTRICAL TERMINAL DIAGRAM

1 = Control-unit plug
2 = To diagnostic plug and engine-speed sensor
3 = Ignition coil
3a = To high-voltage distributor
4 = Plug connection (3- or 6-pin) in glove compartment
5 = Throttle-valve switch
6 = Thermo-time switch
7 = Start valve
8 = Air-flow sensor
8a = Temperature sensor I (air)
9 = Relay 2 (main relay)
10 = Relay 1 (pump relay)
11 = Fuel pump
11a = Pre-supply pump
12 = Pump fuse F11
13 = Term. 10 not assigned on 525e
14 = Vehicle ground for control-unit output stage
15 = Altitude sensor
16 = Temperature sensor (coolant)
17 = Vehicle ground for control unit
18 = Lambda sensor (heated in 325 e only)
19 = Sensor-heating relay (325 e only)
20 = Engine-speed sensor
21 = Reference-mark sensor
22 = Solenoid-operated fuel-injection valves
23 = Engine plugs (No. 7, no. 10 in 325 e, no. 7, no. 12 in 525 e)

H23 — ⟹

H24 — ⟸

TEST EQUIPMENT AND TOOLS

Description	Designation	Part no.
Universal test adapter	ETT 018.01	0 684 101 801
Adapter cable, USA/Japan		1 684 463 128
Adapter cable (replacement for adapter cable 1 684 463 128)		1 684 463 124
Motortester	e. g. MOT 201	0 684 000 201
Diagnostic cable for measuring spark advance		1 684 463 122
Exhaust-gas tester	e. g. ETT 008.02 or ETT 008.03	0 684 100 802 0 684 100 803
Multimeter (internal resistance at least 20 k Ω /V)		Commercially available, e.g. Metrawatt GmbH Type NA2H or Fluke Multimeter 75 or 77
Pressure gauge, 6 bar or Pressure-measuring device or Pressure-measuring device (no longer available) Three-way cable as connector for KDJE-P 100 and KDEP 1034	Quality class 1.0 0.1 bar grad.	1 687 231 154 KDJE-P 100 KDEP 1034 KDJE-P 100/13

Test equipment and tools (continued)

Description	Part no.
Feeler gauge for measuring sensor air gap (up to 1 mm)	Commercially available
Lubricant for engine-speed and reference-mark sensors	Molykote Longterm 2, commercially available
Chassis dynamometer, e.g. LPS 96 or LPS 002	0 680 017 001 0 680 100 200
Test cable 2-pin, for measuring resistance and signals, e.g. of fuel-injection valves	1 684 463 093
Test cables for the correct connecting of test equipment to component plug connections	KDZS 0004 (2.8 mm wide) KDZS 0005 (6.3 mm wide)

BMW exhaust-gas pickup/adapter: BMW no. 130 090/130 100

For USA/Japan:
Tool set for removing and replacing the idle-CO anti-tamper device of the air-flow sensor, e.g. no. 13 1090 of the Cartol Co., Hans Schubert KG
Unterer Grasweg 88, D-8070 Ingolstadt
or from BMW of America

Mounting paste VS 14016 Ft for lambda sensor and exhaust-gas screw plug	5 960 080 105
Spring clip for pinching off fuel and air hoses	Commercially available

Always pay attention to SAFETY AND PRECAUTIONARY MEASURES in order to avoid damage to the engine, control unit or ignition coil, as well as to prevent danger to persons.

1. CAUTION!
   High-output ignition system with dangerous high and low voltages!

   Contact with components or terminals under voltage may be dangerous (both at the primary and secondary ends).

2. When testing the compression, disconnect the Motronic relay. In this way, undesired injection by the injection valves is avoided.

3. Never start engine when battery not firmly connected.

4. Incorrect polarity of the supply voltage, e.g. through incorrect connection of the battery or ignition coil, may lead to the destruction of the control unit.

5. Never use a fast charger for starting the engine. Provide starting aid only using a second 12 V battery and jump leads.
   Caution! Due to non-uniform demands of the vehicle manufacturer made on electronic products, we recommend that a 24 V battery never be used for providing starting aid. Observe the vehicle owner's manual.

6. Disconnect the battery from the vehicle electrical system before boost charging.

7. When charging the battery in the vehicle or providing starting aid, observe the instructions in the operating manual of the fast charger, as well as the instructions from the vehicle manufacturer.

8. Never disconnect the battery from the vehicle electrical system when the engine is running.

9. Never short circuit ignition coil term. 1 to ground (e.g. for switching off the engine). Ignition coil and, under certain circumstances, control unit are destroyed.

10. Never connect the positive battery terminal to ignition coil term. 1. Control unit is destroyed.

11. Never diconnect or connect wiring-harness plug of control unit when ignition is switched on.

12. When temperatures are above +80°C (drying oven), the control unit must be removed.

13. When welding (electric spot welding), the control unit must be removed.

14. When installing an alarm system, observe the installation instructions for Motronic vehicles or the SIS microcard ALL-500.
    Make sure that the alarm relay is not destroyed by external fields (e.g. from ignition cables) so that it responds in a defective manner.

T A B L E O F C O N T E N T S

Trouble-shooting instructions : FOR-5002

BOSCH system : KE-JETRONIC

Make of vehicle : FORD

Basic microcard : AUD-507

SPECIAL FEATURES

These instructions, valid at the time of publication, cover trouble-shooting on the KE-Jetronic (system version KE 2.6) of the following vehicle models:

* FORD Escort Limousine,-Cabrio,-Turnier,
  XR 3 i - 1.6 injection (1.86 ->)

* FORD Orion 1.6 injection (9.85 ->)
  Engine: 4-cyl./ 1.6 l/ 66kW/90 bhp, with
  catalytic converter and lambda closed-loop ctrl.

- The KE-Jetronic in these models corresponds to the basic version with additional lambda closed-loop control.

- When performing trouble-shooting, it is to be noted that the KE-Jetronic and the electronic ignition system (EI-K) have some joint electrical wiring. Various electrical leads are shielded; in some cases several leads have a common shield (see terminal diagram).

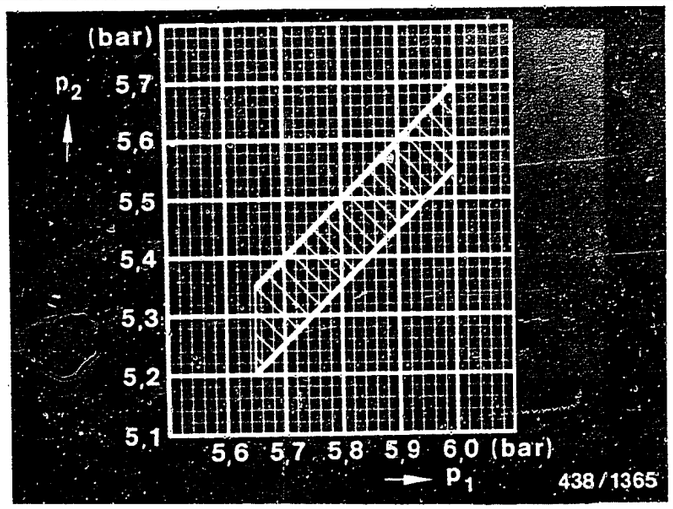
- The vehicles are equipped with a 5-pole diagnosis connection (left-hand wheel house, in area of McPherson strut).
  Pin 4 = Lambda measurement output (integrator voltage) for setting closed-loop control without universal test adapter.

Important:

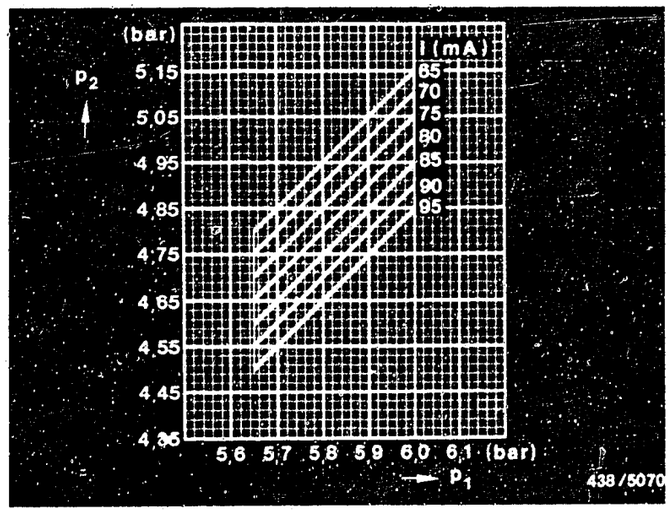
If reference is made to similar, detailed instructions (indicated on KFZ 000), it should be remembered that the test specifications are always to be taken from the vehicle-specific brief instructions.

TEST SPECIFICATIONS

No.	Test/Test conditions	Test specifications	
1	Fuel delivery – electric fuel pump:	min. 800 cm ^{3} /min	
2	Primary pressure:	5,65...6,0 bar	
3	Differential pressure: Take lower-chamber-pressure set value "warm" in accordance with measured primary pressure from upper graph. (Actuator current 10 mA) Take lower-chamber-pressure set value "cold" in accordance with measured primary pressure and actuator current from lower graph. Tolerance ± 0.15 bar. Simulation of "cold" condition: Detach connector at temperature sensor, engine.		
4	Leak test – overall system: Minimum pressure after 10 min.: Minimum pressure after 20 min.:	 2,7 bar 2,6 bar	
5	Opening pressure of injection valves:	3,0...4,1 bar	
6	Fuel-delivery comparative measurement: (Actuator current 10 mA) Idle: Part load: Full load: Minimum quantity with max. deflection of air-flow sensor plate:	Setting: (cm ^{3} /min) 6,0 40,0 100,0 130,0 cm ^{3} /min	Max. perm. quantity: (cm ^{3} /min) 6,0 40,0 109,0



p_1 = Primary pressure
p_2 = Lower-chamber pressure

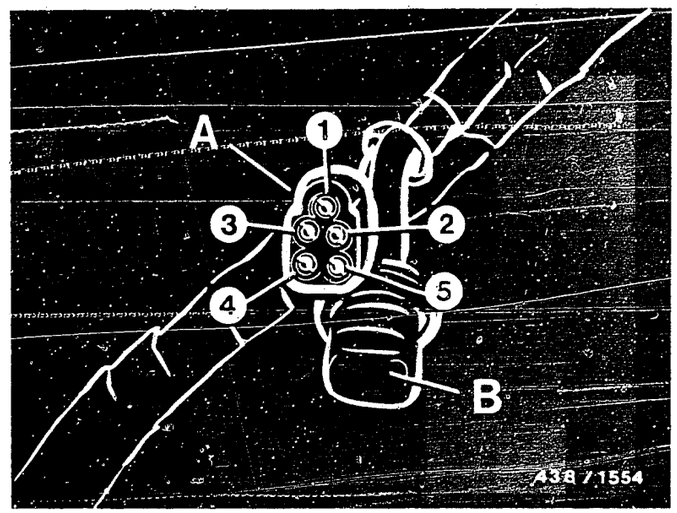


TEST SPECIFICATIONS (CONTINUED)

No.	Test/Test conditions	Test specifications	
7	Flow rate – KE-restriction:	130... 150 cm ^{3} /min	
8	Temperature sensor, engine (NTC):		
	Cold engine (+15...+30°C):	1,3... 3,6 k Ω	
	Engine at operating temperature (approx. +80°C):	250... 390 Ω	
9	Thermo-time switch – resistance measurement:		
		Below +30°C	Above +40°C
	Terminal G and ground:	25... 40 Ω	50... 80 Ω
	Terminal W and ground:	0 Ω	100...160 Ω
	Terminal G and terminal W:	25... 40 Ω	50... 80 Ω
10	Basic setting of idle-mixture-adjusting screw:		
	Fuel-distributor contact surface – needle bearing:	18,7...18,9 mm	
11	Air-flow-sensor potentiometer:		
	Voltage signal, basic setting of air-flow sensor plate	0,01...0,05 V	
12	Auxiliary-air device:		
	Resistance of heater winding:	30...65 Ω	

TEST SPECIFICATIONS (CONTINUED)

No.	Test/Test conditions	Test specifications
13	Idle-speed adjustment : *)	
	Idle speed: (Without fan operation. Adjustment at bypass screw, back of throttle-valve assembly)	875...925 min $^{-1}$
	Exhaust adjustment: (Adjust at idle-mixture-adjusting screw)	
	* Current measurement - mean-value check: - setting:	4...16 mA 9...11 mA
	* Voltage measurement - mean-value check: - mean-value setting:	Approx. 4,5 V Approx. 4,5 V
	* CO content in exhaust gas - check value:	0 vol. %



A = Diagnosis connection at wiring harness, left-hand wheel house
B = Cap
1 = Diagnosis, ignition system (blue/green)
2 = Engine-speed signal (TD) (blue)
3 = NTC signal (coolant) (brown/green)
4 = Lambda signal (blue/white)
5 = Ground (brown)

*) Information on idle-speed adjustment:

Testing and adjustment without fan operation. If necessary, briefly detach connector at temperature switch (radiator).

Exhaust-emission control is effected automatically by way of lambda closed-loop control. Test closed-loop control function with engine and exhaust system at operating temperature. Closed-loop control operation can be seen from the pulsating measured-value display. Adjustment is effected to the mean value of the pulsating measured-value display by turning the idle-mixture-adjusting screw in the mixture-control unit.

It is possible either to test the pressure-actuator control current with the universal test adapter, or alternatively, to save connecting the adapter, to measure the voltage at pin 4 (+) of the diagnosis connection (see illustration) and ground.
For voltage measurement make use of analog voltmeter with R_i =min.20 k Ω , e.g. BOSCH lambda closed-loop control tester KDJE-P 600.

CO check value is used to check whether there is a leak in the exhaust system between engine and area downstream of lambda sensor. Perform test at exhaust tailpipe.

For production reasons:
continued on the following
coordinate.

RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER
ETT 018.01 WITH KE2 ADAPTER CABLE 1 684 463 135 AND
SUITABLE MULTIMETER:

The following rapid diagnosis chart makes it possible for the experienced Jetronic specialist to rapidly test the electrical/electronic peripheral and control-unit functions of the KE-Jetronic, including lambda closed-loop control.

Important information concerning the following rapid diagnosis chart:

The "test conditions" column specifies the test steps during which the control-unit plug must be connected or disconnected. Great care must be taken to ensure that the system is without current during all plugging and unplugging operations, i.e. the ignition must be switched off and the electrical safety circuit must not be bridged.

The "test connections" column indicates the leads in the current path for the measurement being made, with reference to the pin assignment of the control-unit plug. Any trouble-shooting that may be required will involve these leads.

RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER ETT 018.01 (CONTINUED)

No.	Switch/btn V	Ω	btn	Testing of	Test connect-ions	Test conditions	Test specifications
1	| V	4	–	Pressure actuator Internal resistance (R_i)	12 – 10	Detach control-unit connector.	20...30 Ω
2	| V	5	–	Temp. sensor, engine (NTC) Internal resistance	21 – 2	Control-unit connector detached. Engine temperature +15...+30°C: approx. + 80°C:	 1.3...3.6 k Ω 250...390 Ω
3	| V	9	–	Idle throttle-valve switch	13 – 2	Caution: Ohmmeter connection Left-hand, blue socket " Ω ", black socket "V". Control-unit connector detached. Throttle valve closed: Open throttle valve by hand:	 0...10 Ω infinity Ω
4	| V	10	–	Full-load throttle-valve switch	5 – 2	Caution: Ohmmeter connection: Left-hand, blue socket " Ω ", black socket "V". Control-unit connector detached. Throttle valve closed: Completely open throttle valve by hand:	 infinity Ω 0...10 Ω
5	4	—	–	Starting signal, terminal 50	24 – 2	Control-unit connector detached. Actuate starting motor:	 8...15 V

RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER ETT 018.01 (CONTINUED)

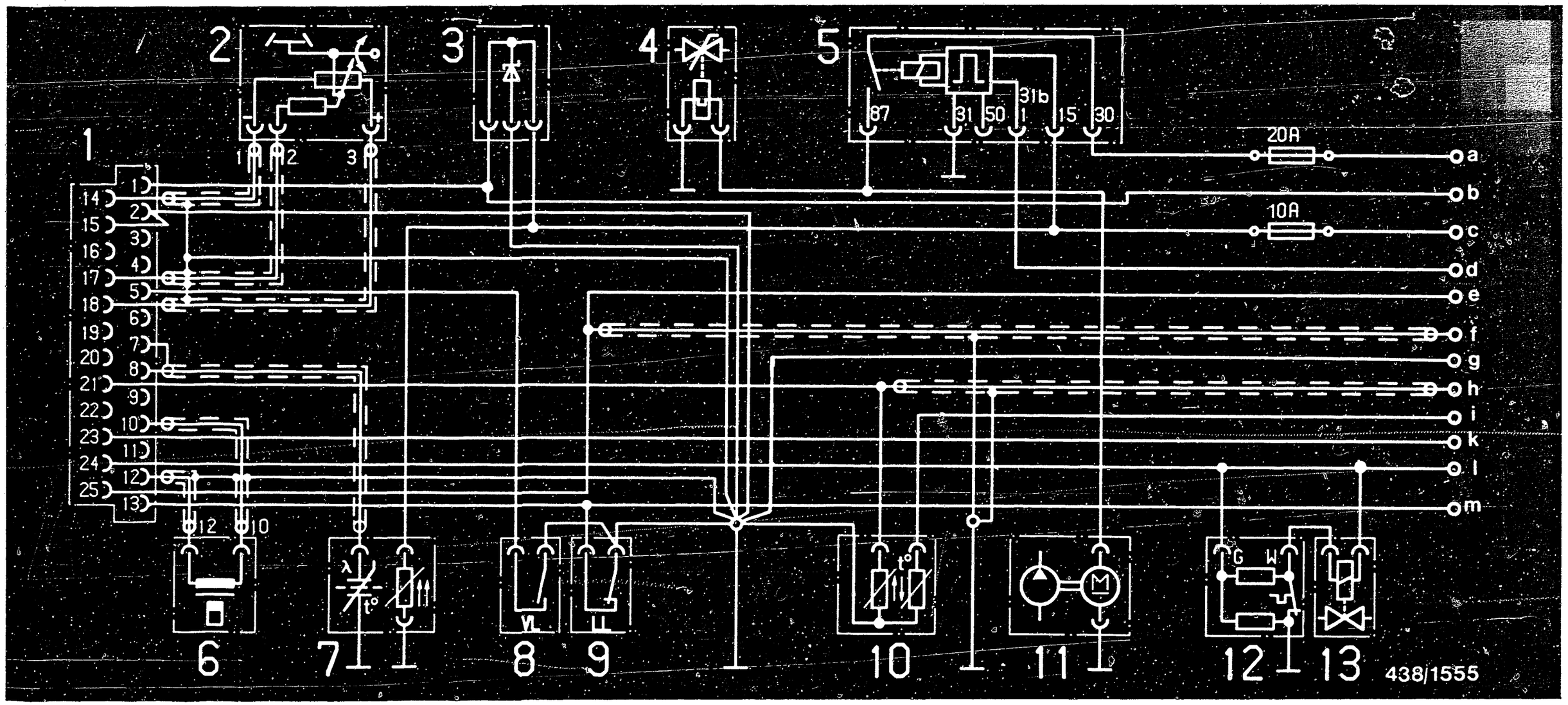
No.	Switch/btn V	Ω	btn	Testing of	Test connect-ions	Test conditions	Test specifications
6	5	—	—	TD signal, ignition	25 - 2	Control-unit connector detached. Actuate starting motor for several seconds:	Voltage value undefined
7	6	—	—	Control unit - supply	1 - 2	Control-unit connector detached. Switch on ignition.	8...15 V
8	7	—	—	Supply, potentiometer, air-flow sensor	18 - 2	Connect control unit. Switch on ignition.	7...8 V
9	8	—	—	Signal - Potentiometer, air-flow sensor	17 - 2	Control unit connected. Switch on ignition. Air-flow sensor plate in off-position: Deflect air-flow sensor plate by hand, continuous voltage increase up to max.:	Approx. 0 V 8 V
10	14	24	—	Lambda closed-loop control Closed-loop function	23 - 2	Control unit connected. Bridge sockets 1 and 2 at test adapter. Engine at operating temperature, idling. Closed-loop control function: fluctuating voltage reading. Mean value:	Approx. 3 V
11	-	-	1	Warm-up enrichment -20°C	12 - 12	Current measurement! Meas.-instrument connection: Negative = Black socket 1 Positive = Black socket 2 Control unit connected. Switch on ignition.	47...67 mA

RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER ETT 018.01 (CONTINUED)

No.	Switch/btn V	Ω	btn	Testing of	Test connect-ions	Test conditions	Test specifications
12	–	21	2	Actuator current Engine at operating temp.	12 – 12	Control unit connected. Switch on ignition.	9... 11 mA
13	–	21	2 / 4	Starting enrichment	12 – 12	Control unit connected. Switch on ignition. Keep button 2 pressed. Triggering of starting enrichment (independent of temperature) with commencement of starting (btn 4): Regulation time approx. 1 second	 120...140 mA
14	–	21	1 /4	Post-start enrichment	12 – 12	Control unit connected. Switch on ignition. Keep button 1 pressed: Press button 4 and keep it pressed. Current increase to: Following brief dwell time, regulation to: Regulation time approx. 90 seconds	 47... 67 mA 120...140 mA 47... 67 mA
15	–	21	1 / 6	Acceleration enrichment	12 – 12	Control unit connected. Switch on ignition. Press buttons 1 and 6 and keep them pressed. Current: Rapidly deflect air-flow sensor plate. Increase in current to: Regulation approx. 1 second to:	 47... 67 mA < 120 mA 47... 67 mA
16	–	21	2	Overrun cut-off	12 – 12	Control unit connected. Reconnect ammeter (interchange positive and negative). Start engine. Hold speed n at approx.: With button 2 pressed, actuate idle throttle-valve switch. Engine "surges". Current reading during decreasing engine-speed phase:	 2000 min $^{-1}$ -40...-80 mA

RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER ETT 018.01 (CONTINUED)

No.	Switch/btn V	Ω	btn	Testing of	Test connect-ions	Test conditions	Test specifications
17	–	21	–	Rotational-speed limitation	12 – 12	Function by means of current polarity reversal as for overrun cut-off. Cut-out speed:	 6300...6500 min $^{-1}$
18	–	21	–	Full-load enrichment	12 – 12	Control unit connected. Start engine. Actuate full-load throttle-valve switch by hand (at throttle-valve assembly, front). Engine-speed range up to approx. 3000 min $^{-1}$ current increase by: Engine-speed range as of approx. 3800 min $^{-1}$ further current increase by:	 1... 3 mA 2... 4 mA
19	–	24	–	Lambda closed-loop control Closed-loop control function	12 – 12	Control unit connected. Engine at operating temperature, idling. Closed-loop control operation can be seen from the fluctuating current reading. Mean value: If mean value not within tolerance, adjust (idle-mixture-adjusting screw) to:	 4...16 mA 9...11 mA
20	–	22	–	Lambda closed-loop control Rich stop	12 – 12	Control unit connected. Switch on ignition. Current increase to:	 18...22 mA
21	–	23	–	Lambda closed-loop control Lean stop	12 – 12	Control unit connected. Switch on ignition. Current decrease to:	 0... 2 mA



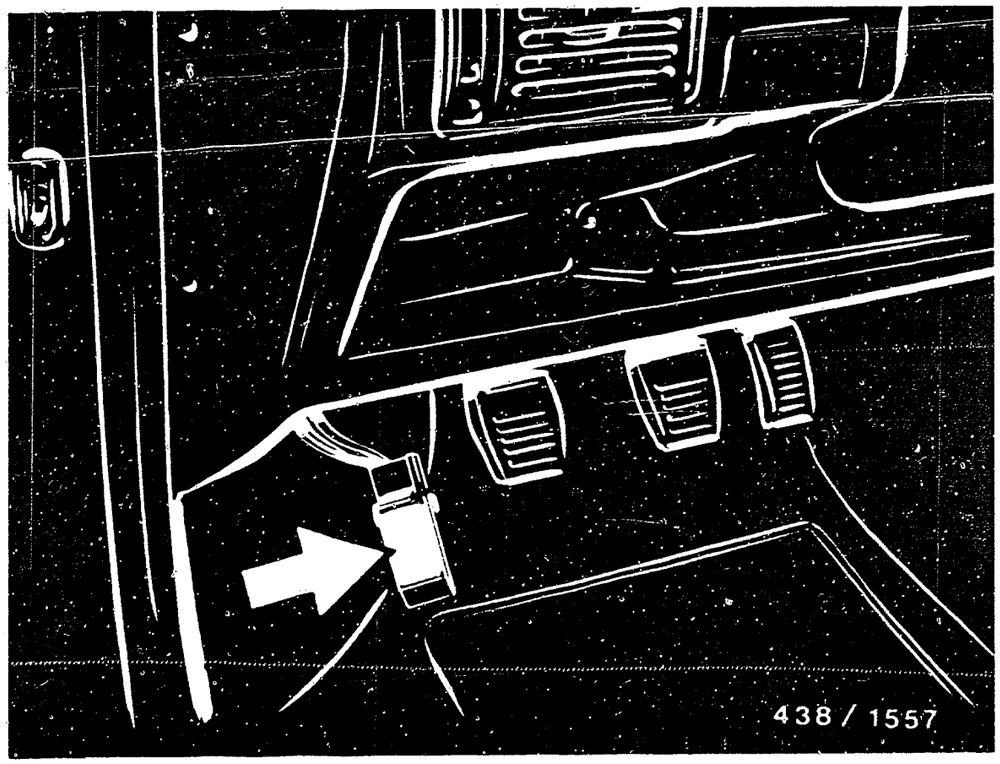
ELECTRICAL TERMINAL DIAGRAM WITH ELECTRIC-FUEL-PUMP SAFETY CIRCUIT

1 = KE-Jetronic control unit
2 = Air-flow-sensor potentiometer
3 = Over-voltage protection relay
4 = Auxiliary-air device
5 = Electronic engine-speed relay
6 = Electrohydraulic pressure actuator
7 = Heated lambda sensor
8 = Full-load throttle-valve switch
9 = Idle throttle-valve switch
10 = Engine temp. sensor (twin NTC)
11 = Electric fuel pump
12 = Thermo-time switch
13 = Cold-start valve

a = Terminal 30
b = Control unit, ignition, term. 6
c = Ignition switch, term. 15
d = Ignition coil, term. 1 (-)
e = Control unit, ignition, term. 17
f = Diag. plug, term. 2 (eng.-spd. signal)
g = Diagnosis plug, term. 5 (ground)
h = Diagnosis plug, term. 3 (temp. signal)
i = Control unit, ignition, term. 25
k = Diagnosis plug, term. 4 (lambda signal)
l = Ignition switch, term. 30
m = Control unit, ignition, term. 7

J19 — ⟹

J20 — ⟸



Arrow = Relay for electric fuel pump

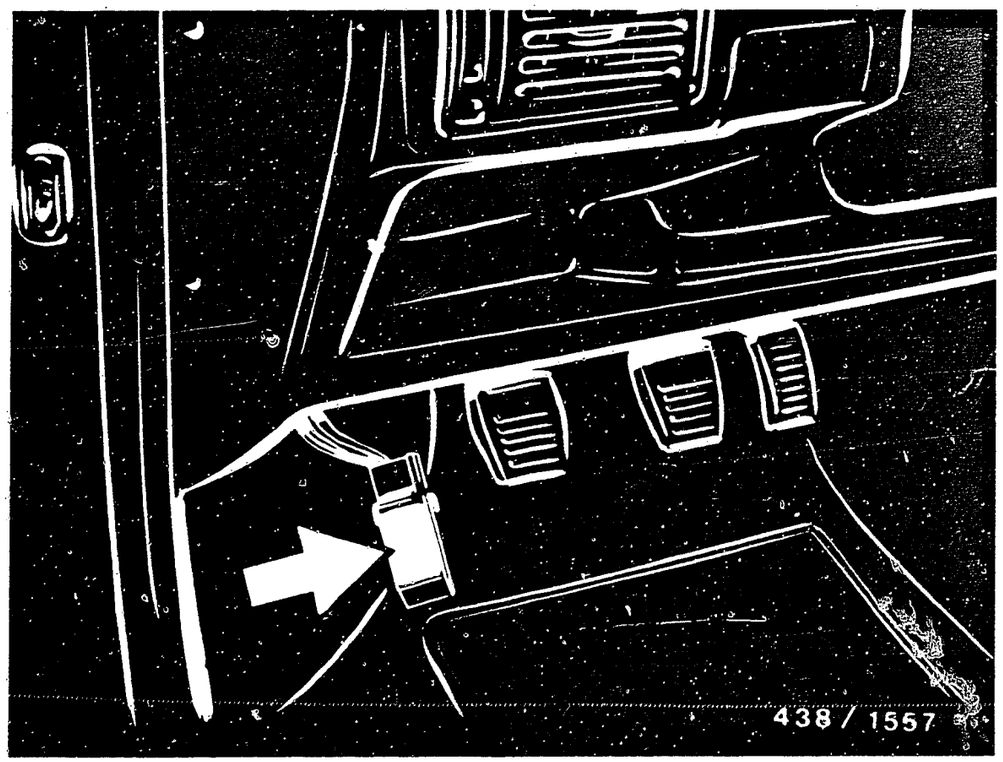
ELECTRICAL SAFETY CIRCUIT

The electronic engine-speed relay for actuating the electric fuel pump is located beneath the instrument panel on the driver's side.

Depending on vehicle version, the over-voltage protection relay (small) is located next to the engine-speed relay.

In other versions the over-voltage protection relay is located in the central-electrics console and marked "KE".

Both relays are fused.



BRIDGING SAFETY CIRCUIT FOR ELECTRIC FUEL PUMP

For bridging purposes, remove relay from holder and detach it from relay frame.

Connect connections 30 and 87 with auxiliary lead (cross-section 1.5 mm ^{2} with fuse element)

I m p o r t a n t :
Function of electric fuel pump is required only for pressure measurements.
Only switch on ignition for electrical tests.

C a u t i o n :

Never deflect (raise) air-flow sensor plate with electric fuel pump running, since otherwise fuel will be injected. Subsequently actuating the starting motor can lead to extremely severe engine damage.

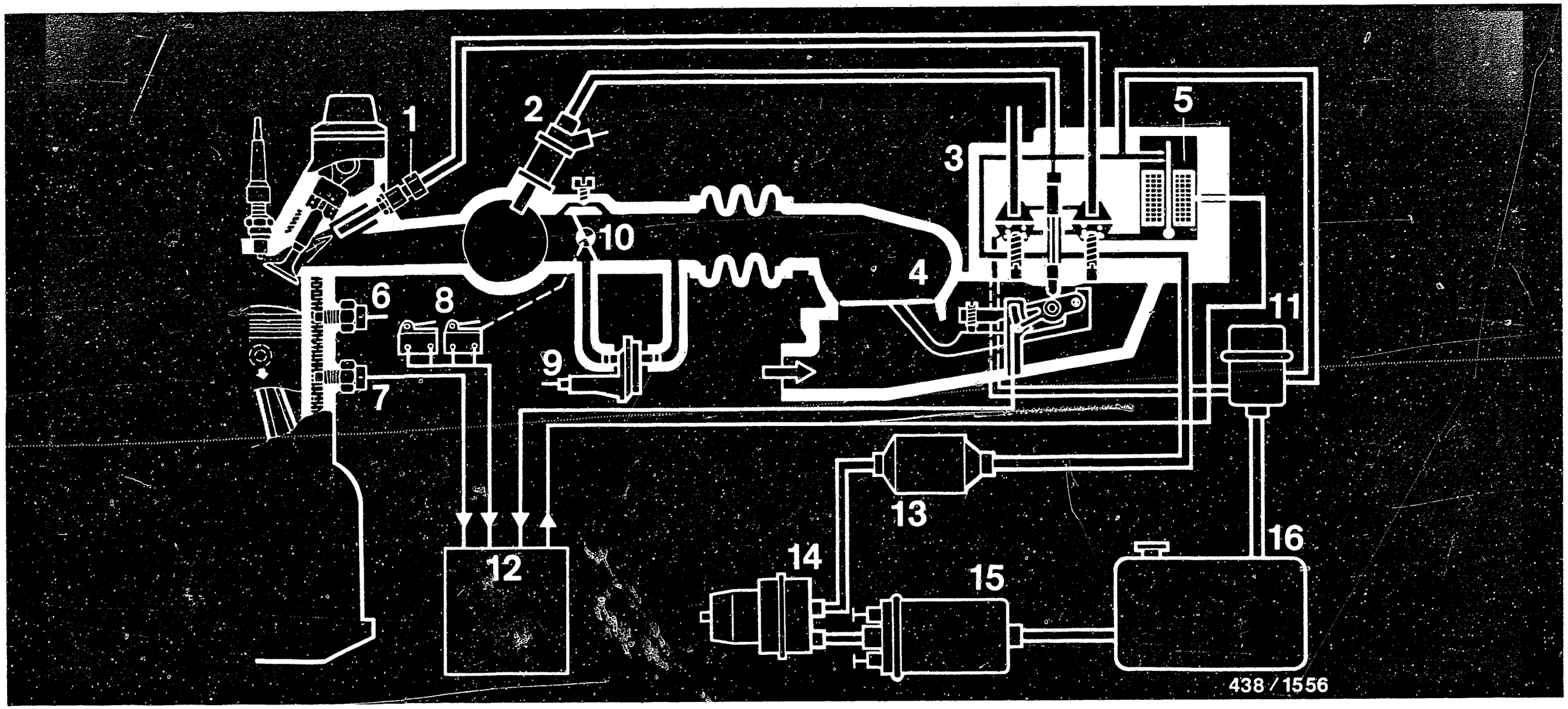


DIAGRAM OF AIR PIPES AND FUEL LINES

1 = Injection valve(s)
2 = Cold-start valve
3 = Fuel distributor
4 = Air-flow sensor
5 = Electrohydraulic pressure actuator
6 = Thermo-time switch
7 = Engine temperature sensor (twin NTC)
8 = Idle/full-load throttle-valve switches
9 = Auxiliary-air device
10 = Throttle valve
11 = Pressure regulator (primary pressure)
12 = KE-Jetronic control unit
13 = Fuel filter
14 = Fuel accumulator
15 = Electric fuel pump
16 = Fuel tank

INSTALLATION POSITION OF COMPONENTS

* Mixture-control unit: On air-filter housing, in area of left-hand, inner wheel house.

* Fuel filter: Beneath mixture-control unit.

* Fuel accumulator: On left-hand, inner wheel house; next to brake booster.

* Throttle-valve switch:
  At throttle-valve assembly, front. Idle switch at bottom, full-load switch at top.

* Cold-start valve: In intake manifold, in area of throttle-valve-assembly mounting flange.

* Auxiliary-air device:
  Beneath throttle-valve-assembly mounting flange.

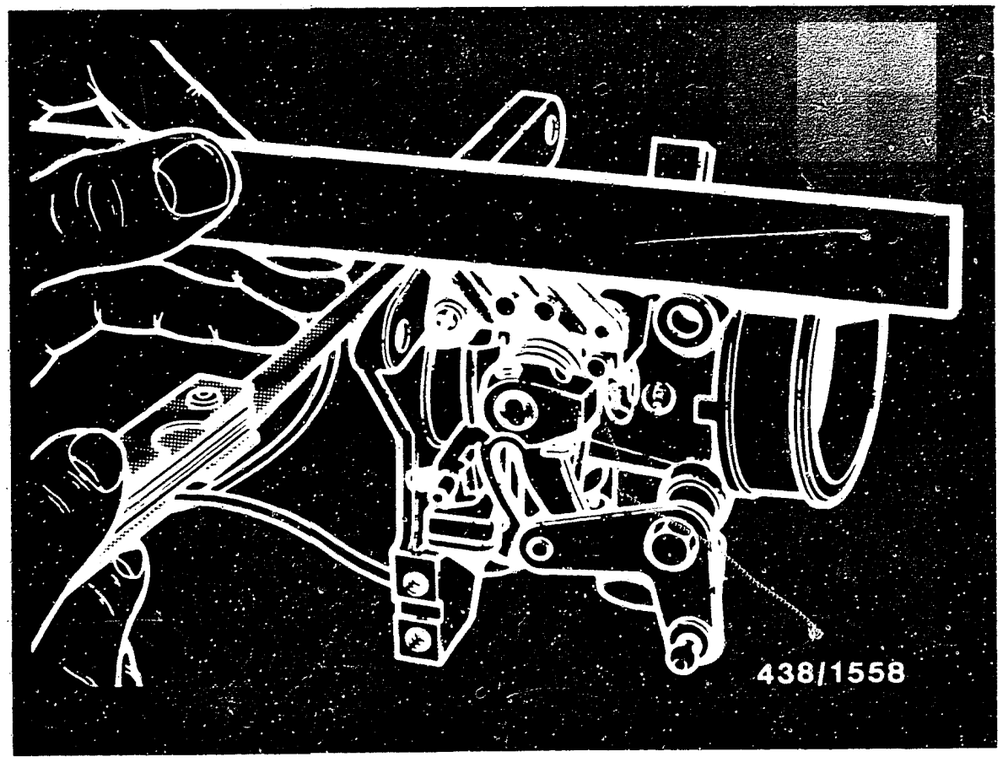
* Injection valves:
  In flanges of intake tubes.

* Lambda sensor: On front side of engine, in exhaust pipe, in area of starting motor.

* KE-Jetronic control unit: The control units for ignition and KE-Jetronic (same housing designs) are located at the engine bulkhead behind the housing for the heating. The KE control unit is on the right in the direction of travel.

* Thermo-time switch, temperature sensor:
  Back of engine, in area above oil filter.

* Electric fuel pump: Underside of vehicle in area above rear axle. A diaphragm-type pressure damping unit is provided for noise attenuation purposes at the connection on the delivery end.



REMOVAL AND INSTALLATION INFORMATION FOR IDLE/FULL-LOAD THROTTLE-VALVE SWITCHES

The two throttle-valve switches can only be replaced together on account of the joint plug connection.

Idle switch: Adjust such that switch closes with throttle valve closed and opens immediately after leaving the throttle-valve closed position.

Full-load switch: Prior to removal, place ruler on top edge of switch and use feeler gauge to measure distance between ruler and throttle-valve-assembly mounting flange (illustration).

Set new switch to dimension determined. Ensure that switch closes when throttle-plate lever reaches full-load position.

IMPORTANT GENERAL INFORMATION

* Never deflect (raise) sensor plate of air-flow sensor when performing tests with electric fuel pump running since this causes fuel to be injected. Such action can lead to extremely severe engine damage when the engine is subsequently started.

* Observe regulations concerning test equipment when testing injection valves with valve tester. Never perform test with fuel intended for driving or with other readily flammable liquids.
The local safety regulations are likewise to be observed when using testing fuel.

* Only perform leak test on engine intake system with permitted leakage detection spray (e.g. Gypoflex). Never use readily flammable liquids. Observe local safety regulations.

* Never start engine when battery is not properly connected and never disconnect battery from vehicle electrical system with engine running.

* Disconnect battery from vehicle electrical system when carrying out fast charging.

* Electronic control units are to be removed in the event of temperatures above 80°C (e.g. drying stove). This likewise applies when performing electric welding work (e.g. spot welding).

* Make sure all wiring-harness connectors are properly attached.

* Never detach or attach connectors of electronic control unit with ignition switched on.

For production reasons:
continued on the following coordinate.

Trouble-shooting instructions : POR-5006

BOSCH system : Motronic M 2.1

Make of vehicle : PORSCHE

Basic microcard : PKW-100

TABLE OF CONTENTS

SPECIAL FEATURES

These trouble-shooting instructions, valid at the time of publication, apply to the following vehicle models:

PORSCHE 944 S (9.86 ->)
with 2.5 l / 4-cyl. engine, 16 valves

*Motronic system M 2.1 with self-diagnosis, actuator diagnosis, switching-signal diagnosis and flashing-code output (55-pole plug).

*Control unit with variant encoding via wiring-harness plug (see notes in basic instructions).

* The fault memory can be read out using the Pocket System Tester KTS 300 (0 684 400 300) with the program module PPG 204 as of status 09.01.89.

Note:
Further diagnosis possibilities (actuator diagnosis etc), which would be feasible with newer program-module statuses, are not evaluated with these vehicles.

Pay attention to operating instructions for KTS 300. Connection of the KTS 300 to the diagnosis socket in the vehicle is via the adapter lead 1 684 465 192 (PORSCHE).

*As an alternative to the KTS 300, the self-diagnosis can be read out by way of the flashing code. The self-diagnosis test table takes account not only of the KTS 300, but also of the flashing code. Actuator and input-signal diagnosis are effected via the flashing code.

*Joint sensor for engine speed and reference mark.

*Individual-cylinder knock control with two knock sensors.

SPECIAL FEATURES (continued)

*Magnetic pulse generator (Hall generator) for cylinder recognition and knock-sensor switching.

*Adaptive lambda closed-loop control (for vehicles with catalytic converter).

*Tank ventilation with pulsed valve.

*Injection valves with copper core and series resistors in positive lead of injection valves.

*TI trigger box as external ignition output stage.

*The vehicle can be fitted at the factory with an alarm system.
If no alarm system is fitted, there is a jumper in the central-electrics console.

*The self-diagnosis test table is arranged according to fault-code nos. indicated by the KTS 300.
In some cases, the "fault indication" column includes two types of fault which can be optionally indicated by the tester, e.g.:

Open-circuit/short-circuit to ground	(= 1st type of fault)
Short-circuit to positive	(= 2nd type of fault)

L03 — <==

For production reasons:
continued on the following coordinate.

L04 — => <=

STRUCTURE AND USAGE

These brief instructions encompass essentially vehicle-specific special features and test specifications (set values).

In accordance with the customer complaint, the trouble-shooting chart leads to different causes/component faults.
For a detailed description of trouble-shooting, see the information in the trouble-shooting chart of the basic instructions.

ATTENTION: Even if reference is made to basic instructions, the set values, terminal assignments and special features of these vehicle-related brief instructions are always binding.

SAFETY AND PRECAUTIONARY MEASURES

In order to keep persons out of danger and to avoid damage to the engine, trigger boxes and control units or to the ignition system, observe the information in the basic instructions.

CAUTION!
High-performance ignition system with dangerous primary and secondary voltages!

Touching voltage-carrying components or terminals may prove fatal (both on the primary and secondary sides).

* Avoid injection of fuel and high-voltage flashovers when testing the compression.
Therefore, disconnect Motronic relay.

TROUBLE-SHOOTING CHART

Customer complaint (fault symptoms)

1. Starting motor operates, engine fails to start or starts only with difficulty.
2. Engine starts but then dies.
3. Idle problems (engine speed, exhaust gas).
4. Poor throttle take-up, flat spot during acceleration.
5. Engine missing (ignition, injection).
6. Maximum engine power/top speed not reached.
7. Fuel consumption too high.
8. Engine running on (dieseling).
9. Engine pinging/knocking.
10. Engine overheating.
11. Fault lamp.

1	2	3	4	5	6	7	8	9	10	11	Cause (component fault)
*	*	*	*	*	*	*	*	*	*	*	Self-diagnosis
*	*	*	*	*	*	*	*	*	*	*	Final-controlling-element diag.
*											Voltage at control unit
*											Engine-speed/reference-mark sensor
*		*			*	*					Fuel pressure
					*						Fuel delivery
	*	*	*	*	*	*					Air-flow sensor
*	*	*	*								Air intake system
*		*	*	*	*						Trigger box
*		*		*	*						Ignition coil
		*	*	*	*	*					Secondary pattern
*	*	*	*		*	*		*	*		Ignition point
		*									Idle speed, CO
		*									Overrun cut-off
		*	*	*							Interference-suppression resistors
		*	*	*							Noise test
				*							Interference
		*			*						Throttle valve
		*	*			*					Tank ventilation
		*	*								Lambda closed-loop control
*	*	*	*	*	*	*		*	*	*	Control unit

SELF-DIAGNOSIS TEST TABLE

Pocket system tester Fault indication	Fault code	Flashing code	Test instructions/Test conditions	Terminals	Set values
Data exchange not possible			Ignition on: Fault lamp lights up. Prerequisite for fault output: Leads to diagnosis plug/fault lamp and power supply to control unit including term. 18 O.K. Leads and power supply O.K., however no fault output: Control unit defective.	13, 18, 22, 19, 37	———
Battery voltage too low too high	11	1111 1211	Supply voltage for control unit too low: Test voltage dips at positive and ground terminal. Charge battery. Supply voltage for control unit too high: Test alternator regulator.	37(+), 19(-)	Greater than 10 V (with engine running) Less than 16 V (with engine running)
Idle switch Short to ground	12	1112 1212	Fault: Idle contact (in throttle-valve switch) permanently closed or short-circuit to ground in lead. Idle contact closed in off position: Actuate throttle valve somewhat:	52	Approx. 0 Ω Infinity Ω
Full-load switch Short to ground	13	1113 1213	Fault: full-load contact (in throttle-valve switch) permanently closed or short-circuit to ground in lead. Full-load contact closed in full-throttle position: Release accelerator pedal somewhat:	53	Approx. 0 Ω Infinity Ω
Engine temp. sensor Op.circ./sh. to B+ Short to ground	14	1114 1214	Test temperature sensor and lead for open-circuit (op. circ.), short-circuit to ground (short to ground) and short-circuit to positive (sh. to B+): Temperature-sensor resistance: at +15...+30°C: at approx. +80°C:	45	1450...3300 Ω 280... 360 Ω
Air-flow sensor/ Air-mass sensor Signal too low Signal too high	21	1121 1221	Signal too low: Test lead to air-flow sensor term. 2 for short-circuit to ground. Open-circuit in leads to term. 2 and term. 3 or term. 4 and term. 3 jumpered. Signal too high: Test for open-circuit in lead to air-flow sensor term. 4. Test for short-circuit to positive in leads to term. 4 and term. 2. Continued on next Coordinate.	7, 12, 26	———

SELF-DIAGNOSIS TEST TABLE (CONTINUED)

Pocket system tester Fault indication	Fault code	Flashing code	Test instructions/Test conditions	Terminals	Set values
Air-flow sensor/ Air-mass sensor Signal too low Signal too high			Basic tests: Test resistances at air-flow sensor: between term. 2 and term. 4 (deflect sensor flap): between term. 3 and term. 4: Measure wiper voltage at term. 2 with plug connected and ignition switched on: Sensor flap in off position: Slowly deflect sensor flap as far as full load:		 8...2500 Ω 500...1100 Ω 200... 300 mV > 4,2 V
Lambda control outside min. range outside max. range	23	1223 1223 1221	Test CO content (ahead of catalytic converter): Test intake system for leaks. Test fuel pressure. Injection valves or sensor defective.	28	0,4...1,2vol.%
Lambda sensor Open circuit Grond short Short to B+	24	1124 1224	Test lead for open-circuit, short-circuit to ground and short-circuit to positive (short to B+) Watch out for worn cable insulation! Sensor heater defective. Sensor clogged.	28	———
Air-temp. sensor Op.-circ./sh. to B+ Short to ground	25	1125 1225	Test temp. sensor and lead for open-circuit (op. circ.), short-circuit to ground (short to ground) and short-circuit to positive (sh. to B+). Temperature-sensor resistance: at +15...+30°C:	44	1450...3300 Ω
Knock sensor 1 incorrect/no signal	31	1131 1231	Test leads to knock sensor 1 and 2 for open-circuit and mutual contact. Visually inspect knock-sensor plug (mechanical damage, oxidation).	11, 30	
Knock sensor 2 incorrect/no signal	32	1132 1232	Watch out for worn cable insulation! Test tightening torque at knock sensor:	29, 30	15...25 Nm
Control unit Knock control module defective	33	1133 1233	Control unit defective		

SELF–DIAGNOSIS TEST TABLE (CONTINUED)

Pocket system tester Fault indication	Fault code	Flashing code	Test instructions/Test conditions	Terminals	Set values
Cylinder detection incorrect/no signal	34	1134 1234	Test leads to magnetic pulse generator (Hall generator) for open–circuit. Test voltage supply at magnetic–pulse–generator plug term. 1 (+) and term. 3 (–): Functional test: Measure signal at connected magnetic–pulse–generator plug between term. 2 (0) and term. 3 (–); Start engine:	8 (0) 30(–) 31(+)	 Greater than 10 V Rectangular pulses
Control unit Digital sec.(comput) defective	41	1141 1241	Motronic control unit defective.	—	———
No fault stored	0	15	Continue trouble–shooting with trouble–shooting chart.	—	———

ACTUATOR AND INPUT–SIGNAL DIAGNOSIS TEST TABLE

Flashing code	Testing of component/function	Test instructions/Test conditions	Terminals	Set values
1 3 1 1	Injection valves	Detach plugs of all injection valves. Connect one injection valve in each case. The connected injection valve must be heard to function. Perform test consecutively on all injection valves. Test injection–valve internal resistance: Test for short–circuit and open–circuit in connecting leads from control unit to injection valves. Test lead from Motronic relay including series resistors.	14, 17	 2...3 Ω

FINAL-CONTROLLING-ELEMENT AND INPUT-SIGNAL DIAGNOSIS TEST TABLE (continued)

Flashing code	Testing of component/function	Test instructions/test conditions	Terminals	Set values
1 3 2 1	Idle actuator	Idle actuator must be heard or felt to function. Check internal resistance of idle actuator. Check leads from control unit and ignition/starting switch to idle actuator for short-circuit or open-circuit.	4	Approx. 8 Ω
1 3 2 2	Tank-ventilation valve	Tank-ventilation valve must be heard or felt to function. Check internal resistance of tank-ventilation valve. Check leads from control unit and ignition/starting switch to tank-ventilation valve for short-circuit or open-circuit.	5	35...55 Ω
1 3 3 2	Throttle-valve switch Idle contact	In the event of flashing-code output, slightly open throttle valve. Flashing code goes out if signal O.K.	52 19	Approx. 0 Ω
1 3 3 3	Throttle-valve switch Full-load contact	In the event of flashing-code output, open throttle valve completely. Flashing code goes out if signal O.K.	53 19	Approx. 0 Ω
1 3 3 4	Switch, air conditioning ready	In the event of flashing-code output, switch on A/C (if provided). Flashing code goes out if signal O.K.	41 B-	Approx. battery voltage
1 3 3 5	Switch, refrigerant compressor	Leave A/C switched on (if provided). Flashing code goes out if signals O.K.	40 B-	Approx. battery voltage

* Pressure regulator	
Fuel pressure	3,8 ±0,2 bar
* Electric fuel pump	
Fuel delivery (measured in return line)	min. 900 cm ^{3} /30s
Suppy voltage (under load):	min. 12 V
* Temperature sensor (intake air)	
Internal resistance measured at air-flow sensor between term. 1 and term. 4 at ambient temperature (+15...+30 °C) :	1450...3300 Ω
* Temperature sensor (engine)	
Internal resistance at ambient temperature (+15...+30 °C) :	1450...3300 Ω
Engine at operating temperature (approx. +80 °C) :	280... 360 Ω
* Solenoid-operated injection valve	
Internal resistance at ambient temperature (+15...+30 °C) :	2... 3 Ω
* Series resistors	
Resistance in each case	5... 7 Ω
* Air-flow sensor	
Internal resistance between:	
term. 2 and term. 4 :	8...2500 Ω (1)
term. 3 and term. 4 :	500...1100 Ω

(1) Slowly deflect air-flow sensor flap as far as it will go.
Resistance fluctuates between the terminals of the potentiometer.

* Engine-speed sensor and reference-mark sensor	
Internal resistance between term. 1 and term. 2 at ambient temperature (+15...+30 °C) :	400...800 Ω
Air gap:	0,8 ±0,3 mm
* Throttle-valve switch	
Resistance of idle contact (term. 2 and term. 18) :	0 Ω
Resistance of full-load contact (term. 3 and term. 18):	0 Ω
* Idle actuator	
Internal resistance at +15...+30 °C between term. 2 and term. 2 :	8 Ω
* Lambda sensor	
Resistance of heater winding	1...15 Ω
* Ignition coil	
Primary resistance:	0,4...0,6 Ω
Secondary resistance:	5,0...7,2k Ω
* Interference-suppression resistors	
H.T. distributor rotor:	1 k Ω
H.T. distributor dome:	each 1 k Ω
Spark-plug connector:	each 3 k Ω

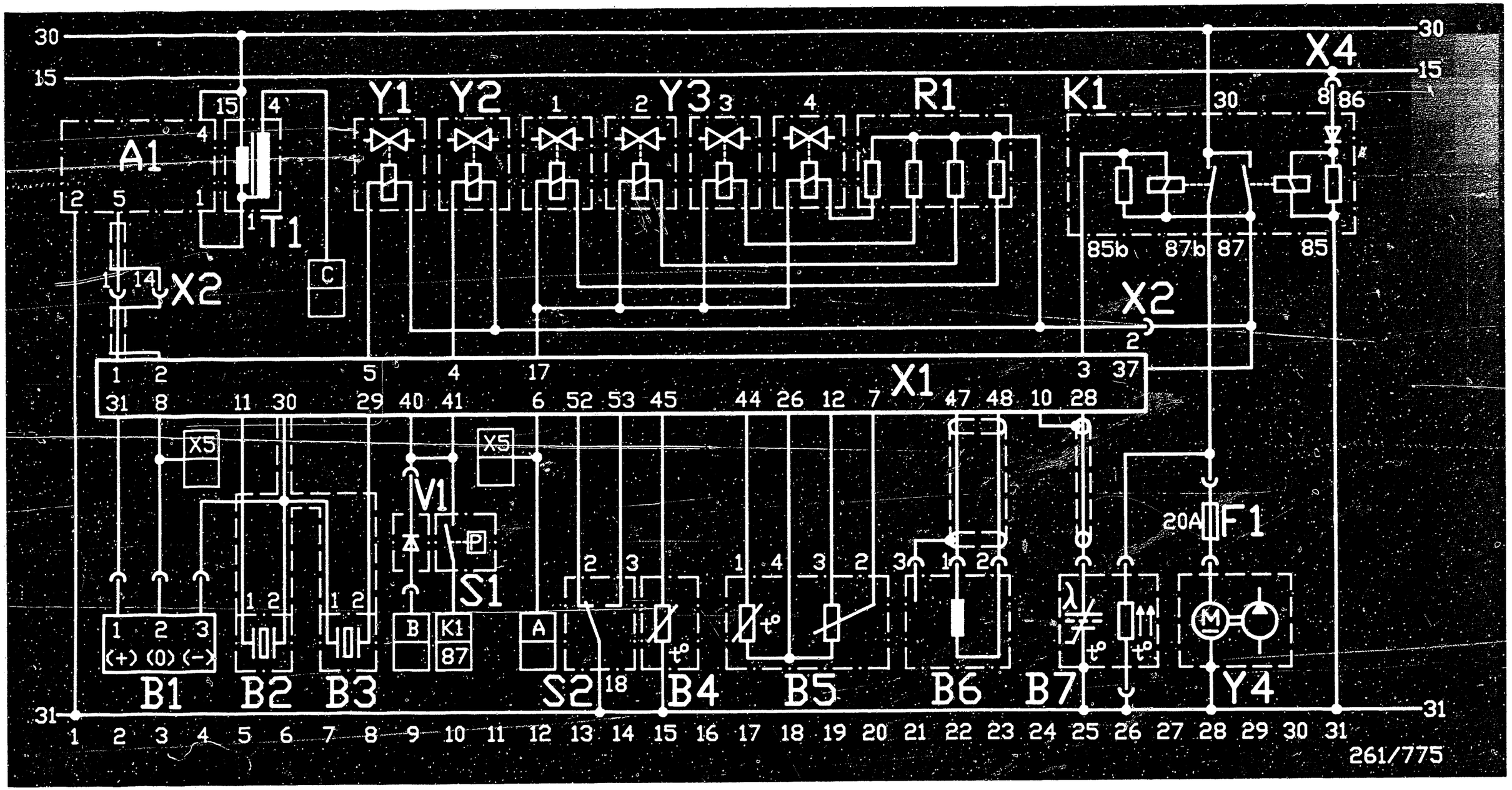
TEST SPECIFICATIONS (CONTINUED)

* Magnetic pulse generator (Hall generator) Voltage supply with ignition "on": Function: rectangular pulse at cranking speed.	> 10V
* Tank-ventilation valve: Internal resistance at ambient temperature (+15...+30 °C) :	35...55 Ω
* Knock-sensor tightening torque: Do not use any lock washers!	15...25 Nm
* Ignition output stage (trigger box): Voltage supply with engine idling:	12...14 V
* Idle test: Engine at operating temperature, switch off loads. Idle speed: Spark-advance angle:	840 ±40 min $^{-1}$ 10 ±3 °crankshaft.

For production reasons:
continued on the following
coordinate.

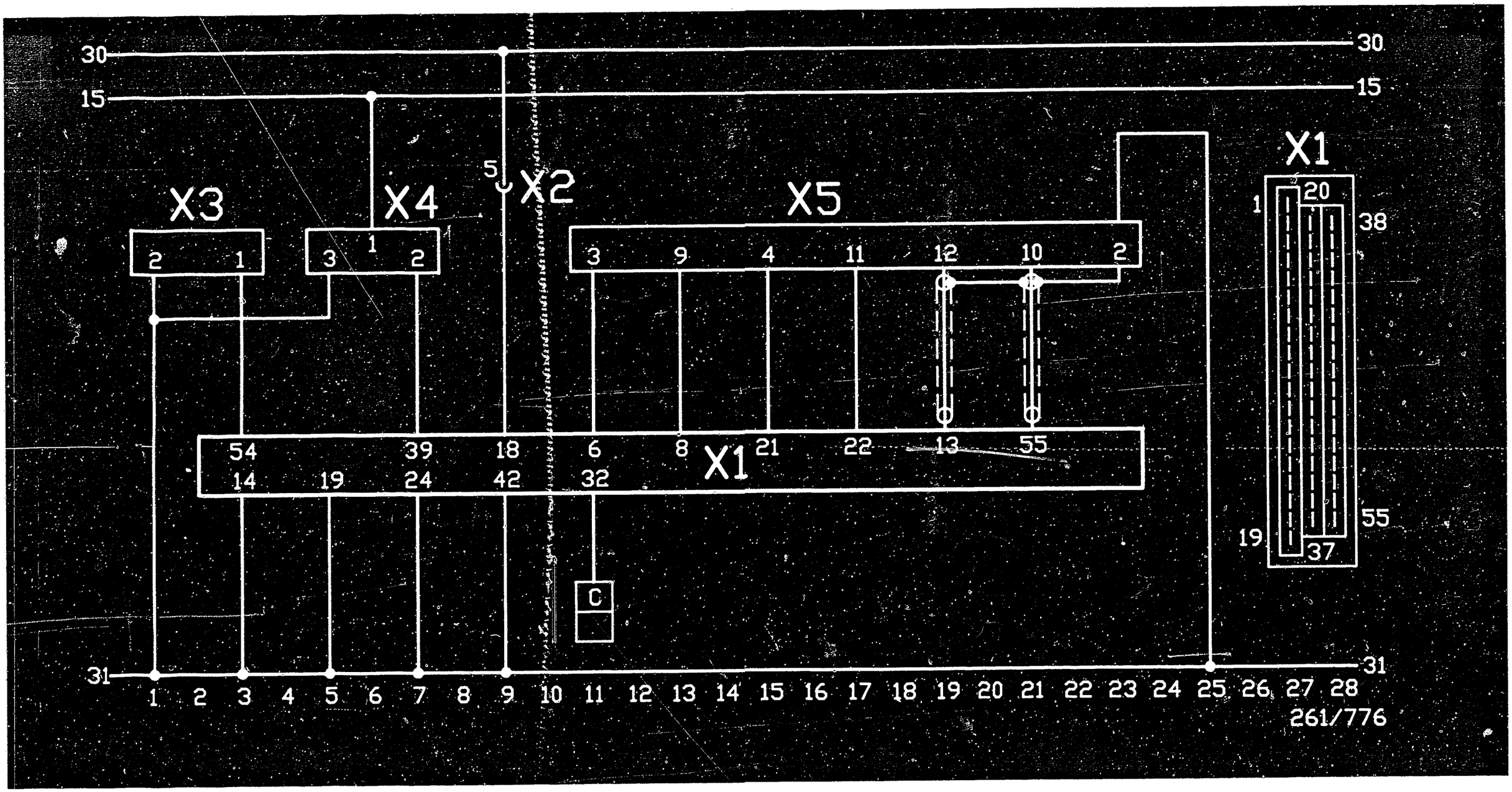
* CO content (no catalytic converter) % CO. Adjust mixture at bypass screw in air-flow sensor: Turning in a counter-clockwise direction. makes the mixture leaner; turning in a clockwise direction makes the mixture richer.	: 0,5...1,5 vol
* Vehicles with catalytic converter % CO (measure CO ahead of catalytic converter if sampling point provided, disconnect plug of Lambda sensor).	: 0,4...1,2 vol.

Please refer to equipment and Autodata microcard as
regards settings for other engine-related data.



ELECTRICAL TERMINAL DIAGRAM

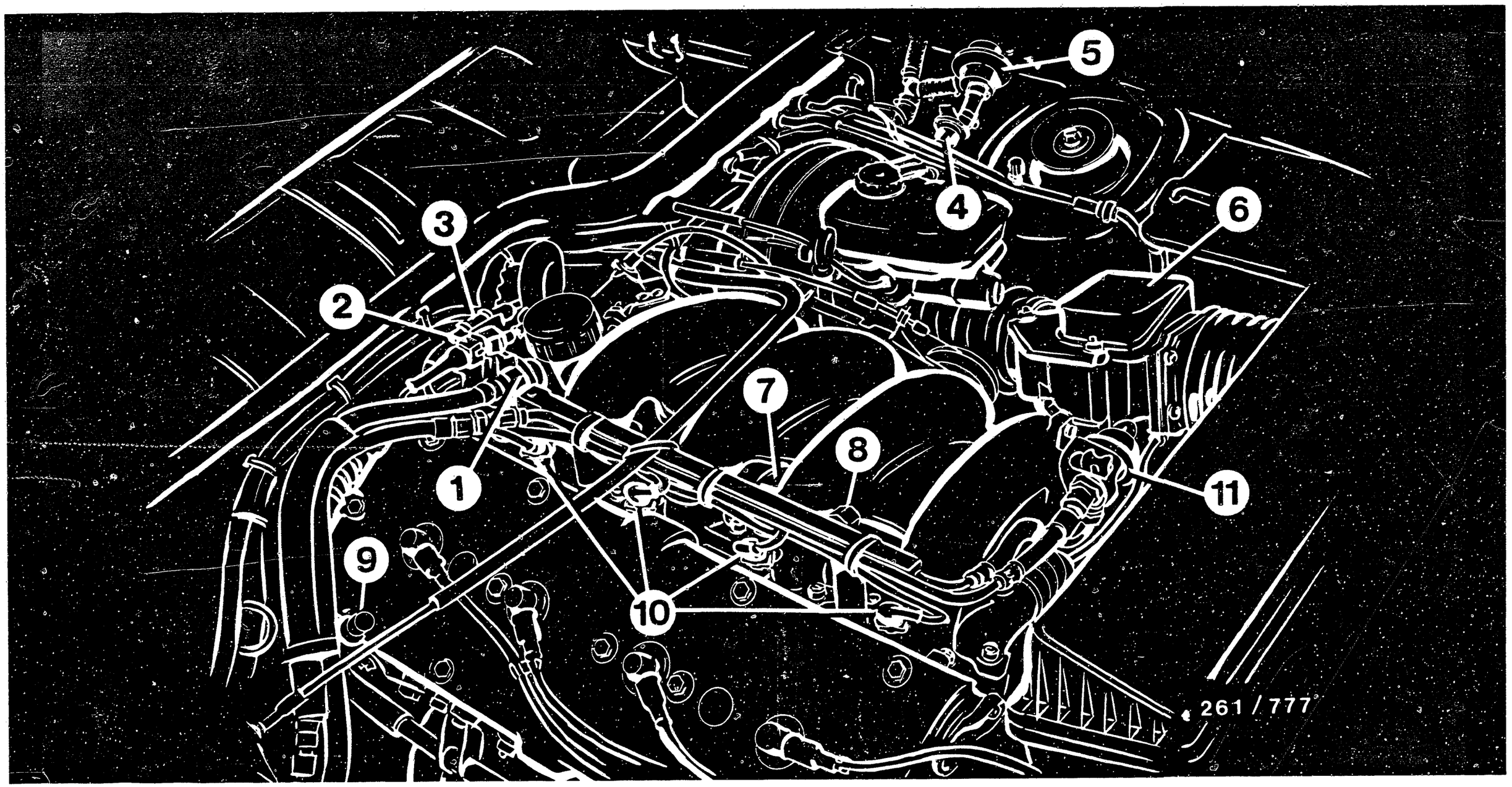
A1 = Ignition trigger box
B1 = Magnetic pulse gen. (Hall generator)
B2 = Knock sensor 1
B3 = Knock sensor 2
B4 = Temperature sensor (engine)
B5 = Air-flow sensor
B6 = Engine-speed/reference-mark sensor
B7 = Lambda sensor
F1 = Fuel pump fuse
K1 = Motronic relay
R1 = Series resistors
S1 = Switch, power-assisted steering
S2 = Throttle-valve switch
T1 = Ignition coil
1 = Protective diode
X1 = Control-unit plug
X2 = Engine plug
Y1 = Tank ventilation valve
Y2 = Idle actuator
Y3 = Injection valves
A = to tachometer
B = to air conditioner
C = to high-tension distributor



ELECTRICAL TERMINAL DIAGRAM (continued)

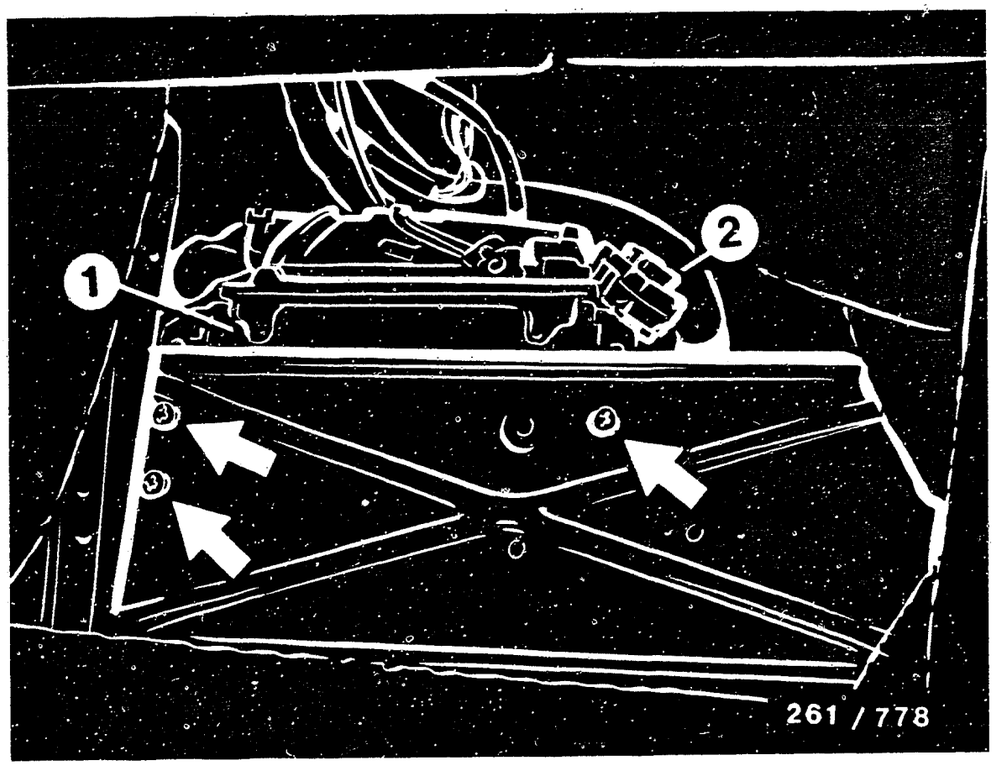
X1 = Control-unit plug
X2 = Engine plug
X3 = Encoding plug
X4 = Variant plug

X5 = Diagnosis plug in passenger compartment
C = to consumption indicator



INSTALLATION POSITION OF COMPONENTS

1 = Fuel pressure regulator
2 = Plug connection, engine-speed/ reference-mark sensor
3 = Plug connection, Lambda sensor
4 = Tank-ventilation valve
5 = Diaphragm valve for tank ventilation
6 = Air-flow sensor
7 = Idle actuator
8 = Test connection for fuel pressure
9 = CO sampling point for vehicles with catalytic converter
10 = Solenoid-operated injection valves 1 - 4
11 = Pressure damper



1 = Motronic control unit
2 = Diagnosis plug

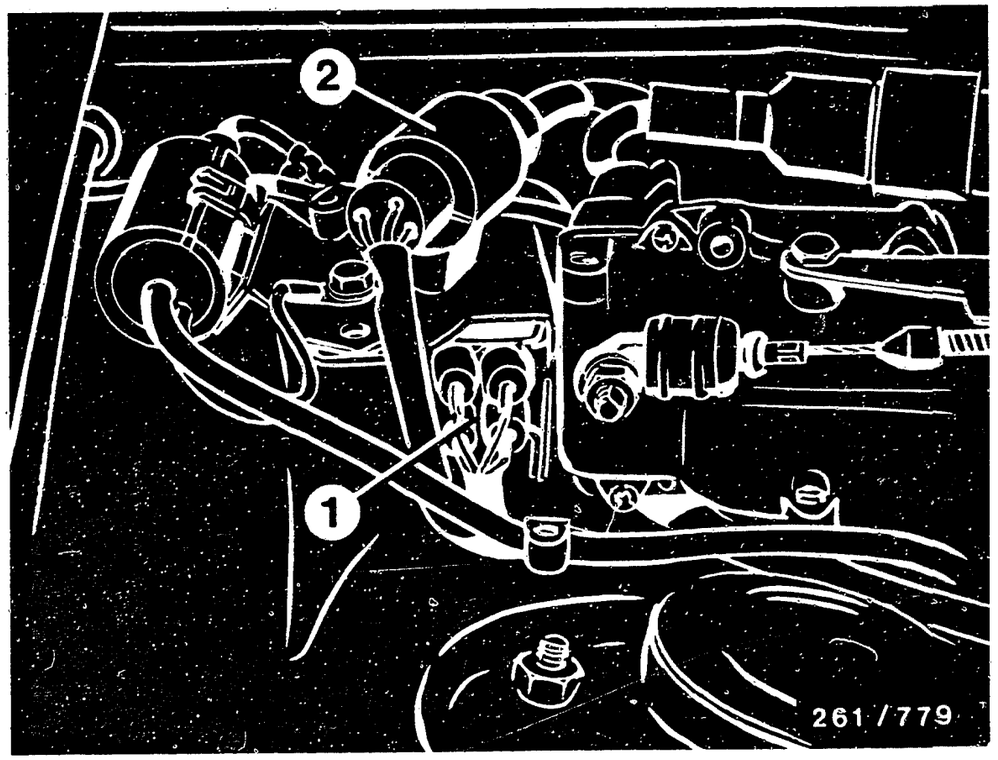
INSTALLATION POSITION OF COMPONENTS (CONTINUED)

The Motronic control unit is located in the passenger-side footwell beneath the floor panel.

Three screws (arrows) have to be loosened to remove the control unit.

* Motronic relay:
  In central-electrics console, relay G5

* Fuse for electric fuel pump:
  In central-electrics console, fuse no. 34



1 = Series resistors
2 = Plug connection

INSTALLATION POSITION OF COMPONENTS (CONTINUED)

The series resistors are located on the right in the direction of travel at the bulkhead.

* Ignition trigger box:
  On a heat sink on the left-hand inner fender near the headlight.

* Throttle-valve switch:
  Beneath the throttle-valve assembly.

* Engine connector:
  On bulkhead, left near servo unit.

* Tank-ventilation system:
  The tank-ventilation valve and diaphragm valve are located on the bulkhead, left.

* Magnetic pulse generator (Hall generator):
  Behind driving gear of outlet camshaft.

* Ignition coil:
  On right-hand inner fender.

* Temperature sensor (engine):
  At front of engine beneath intake manifold.

* Idle actuator:
  Between intake manifolds of cylinders 2 and 3.

* Knock sensor 1 (cylinders 1 + 2):
  Beneath intake manifold, between cylinders 1 and 2.

* Knock sensor 2 (cylinders 3 + 4):
  Beneath intake manifold, between cylinders 3 and 4.

  R e m o v a l :
  The intake manifold must be removed for reasons of space, in order to be able to tighten the knock sensor to the prescribed torque.

* Lambda sensor:
  In joint exhaust pipe.

* Electric fuel pump and fuel filter:
  In rear of vehicle, near rear axle.

Trouble-shooting instructions: BMW-5008

BOSCH system : Electronic transmission control GS 1.2

Vehicle make : BMW

Basic microcard : BMW-528

TABLE OF CONTENTS

SPECIAL FEATURES

These trouble-shooting instructions, valid at the time of publication, apply to the following vehicle models:

* BMW 730i with 3.0 l / 6 cyl. as of 1.87
  BMW 735i with 3.5 l / 6 cyl. as of 10.86
  BMW 750i with 5.0 l / 12 cyl. as of 8.87

* Electronic transmission control GS 1.2 with self-diagnosis and flashing-code output (testing with universal test adapter not required).

* The fault memory can be read out using the Pocket System Tester KTS 300 (0 684 400 300) with the program module PPG 204 as of status 09.01.89.

  Note:
  Further diagnosis possibilities (actuator diagnosis etc), which would be feasible with newer program-module statuses, are not evaluated with these vehicles.

  Pay attention to operating instructions for KTS 300. Connection of the KTS 300 to the diagnosis socket in the vehicle is via the adapter lead 1 684 463 196 (BMW).

* As an alternative to the KTS 300, the self-diagnosis can be read out by way of a flashing code (not possible with all control units).

* The self-diagnosis test table takes account of both the KTS 300 and the flashing code and is arranged according to fault-code nos. indicated by the KTS 300.
  In some cases, the "fault indication" column includes two types of fault which can be optionally indicated by the tester, e.g.:
  Open-circuit/short-circuit to ground (= 1st type of fault)
  Short-circuit to positive (= 2nd type of fault)

SPECIAL FEATURES (CONTINUED)

* Control unit features 35-pole plug.

* EPC interface (there is no throttle-valve potentiometer with Electronic Engine-Power Control; information on the throttle-valve position is provided by the EPC control unit).

* Adaptive pressure control.
  Function:
  -Monitoring of shift times by way of compensation for disturbances such as change in coefficient of friction in multi-plate clutches, tolerances of actuators or decreasing engine power.
  -Desired/actual comparison of shift times.
  -Storage of correction values (non-volatile memory with continuous voltage supply).

If no fault is found in the transmission control, trouble-shooting is to be continued with the Motronic.

STRUCTURE AND USAGE

These brief instructions encompass essentially vehicle-specific special features and test specifications (set values).

In accordance with the customer complaint, the trouble-shooting chart leads to different causes/component faults.
For a detailed description of trouble-shooting, see the information in the trouble-shooting chart of the basic instructions.

ATTENTION: Even if reference is made to basic instructions, the set values, terminal assignments and special features of these vehicle-related brief instructions are always binding.

SAFETY AND PRECAUTIONARY MEASURES

In order to keep persons out of danger and to avoid damage to the engine, trigger boxes and control units or to the ignition system, observe the information in the basic instructions.

CAUTION!
High-performance ignition system with dangerous primary and secondary voltages!

Touching voltage-carrying components or terminals may prove fatal (both on the primary and secondary sides).

* Transmission oil:

  With automatic transmissions, even slight deviations from the specified oil level or incorrect grade of oil can lead to a noticeable deterioration in the quality of shifting. Major deviations may even result in incorrect shifting.

TROUBLE-SHOOTING CHART

Customer complaint (fault symptoms)

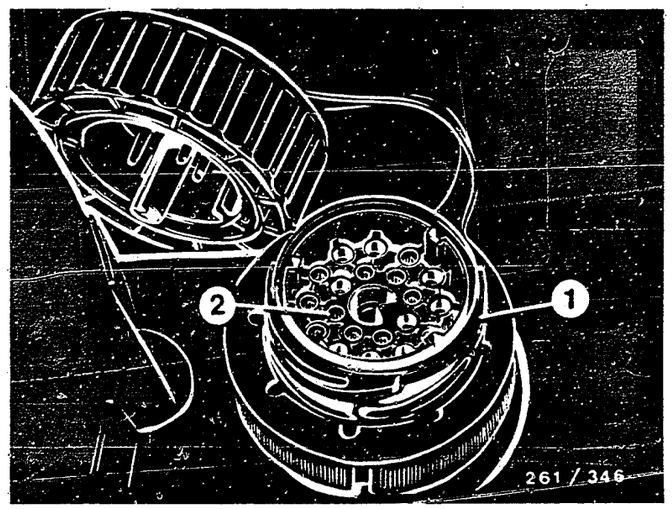
1. Fault message "Transmission" in check control.	2. Engine fails to start.	3. Engine stalls in drive position.	4. No shifting or shifting incorrect.	5. Poor transitions when shifting.	6. No full-load shifting	7. Full-load shifting only	8. Manual downshifts not O.K.	9. Hard jolt when selecting reverse gear	10. Reverse gear not selectable	Cause (component fault)
*	*	*	*	*	*	*	*	*	*	Self-diagnosis
*	*									Main relay defective
*										Voltage at GS control unit
			*	*						Throttle-valve sensor
	*		*							Open circuit or contact resistance at ground terminal
*			*							Plug dropped off transmission or defective
	*									Starting-interlock relay
	*		*	*						Selector switch
			*	*			*			Program switch
		*								Idle contact
		*								Idle actuator
		*								Idle speed
					*					No kick-down contact
						*				Kick-down constantly grounded
*				*				*		Pressure regulator
				*						No engine-torque reduction
			*	*						Solenoid-operated valve(s)
			*							RPM sensor
		*								Converter clutch not releasing
				*						Interference
*			*	*	*	*	*	*		GS control unit defective

M05 —— => <=

For production reasons:
continued on the following coordinate.

M06 —— => <=

ACTIVATION OF SELF-DIAGNOSIS



1 = Diagnosis socket
2 = Terminal no. 20

Procedure to be employed with pocket system tester KTS 300:

* When employing the pocket system tester, attention is to be paid to its operating instructions.
  Connect KTS 300 via adapter lead 1 684 463 196 (BMW) to diagnosis socket in vehicle.

Procedure to be employed when not using pocket system tester (evaluate flashing code):

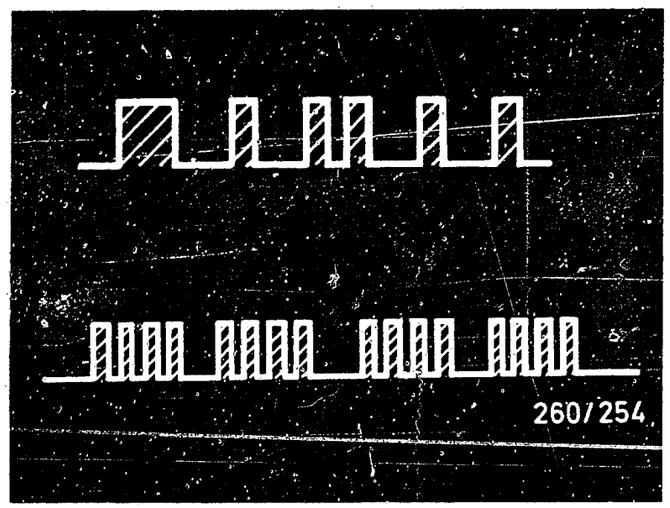
* To read out the flashing code, a fault lamp (after-sales-service tool KDAW 9980: socket 1 (positive) and 2) is to be connected between connection 20 of the diagnosis socket and battery positive.

* With ignition switched off and vehicle stationary, engage driving position 1, switch on ignition and enter following program sequence within 20 seconds using the program button:
  S-program
  E-program
  S-program

* Fault output starts with a start pulse for 2,5 seconds. After the start pulse, the first stored fault is output. This is repeated constantly. In between there is a pause of 2,5 seconds as delimitation.

Top = Fault code 1211
Bottom = Flashing code 4444
(no fault stored)
Hatched pulse area =
Fault lamp lights up

* Renewed stimulation by way of entering the program sequence
  E-program
  S-program
  causes the next fault to be output etc.
  A maximum of 5 faults can be stored.



* The flashing code for each fault consists of 4 flashing-code pulse blocks. Each block represents a number and contains between 1 and 4 pulses. One pulse corresponds to the number 1, 4 pulses correspond to the number 4. The fault lamp lights up briefly with each pulse. There is a longer pause between the blocks than between the individual pulses.

* Clearing fault memory:
  Clear fault memory after eliminating the faults which have been output. To do so, disconnect control unit or negative terminal of battery for several minutes.

SELF-DIAGNOSIS TEST TABLE

Pocket system tester Fault indication	Fault code	Flashing code	Test instructions / Test conditions	Terminals	Set values
Data exchange not possible			Prerequisite for fault output: leads to diagnosis plug/fault lamp and power supply for control unit O.K.	12 13	——
Control unit Digital sec.(comput) defective	1	1311	GS control unit defective.	—	——
Kickdown switch Short to ground	3	1121	Test switch and lead to control unit for short-circuit to ground. Kick-down switch closed in full-throttle position:	2	Approx. 0 Ω (continuity)
Program key Short to ground	4	1122	Fault: Program display does not change despite actuating program button. Test for short-circuit to ground in button and leads to control unit. Program display in instrument panel O.K.? If there are no problems with program button, leads and program display, then GS control unit is defective.	4 14 15	——
Throttle-valve signal incorrect/no signal	5	1123	Trouble-shooting without EPC: Test for open-circuit or short-circuit to ground in wiper/positive lead of throttle-valve potentiometer. Determine resistances at throttle-valve potentiometer: Pins 1/2: Pins 3/2: Trouble-shooting with EPC: Test corresponding lead between EPC and GS control unit for open-circuit and short-circuit to ground or short-circuit to positive. Test throttle-actuated-valve signal at open GS control-unit plug (term. 32) with voltmeter (switch on ignition): Continue trouble-shooting with EPC.	 9 6 7 6 32	 3... 5 k Ω 250...800 Ω and increases constantly on opening throttle valve. Voltage increases on acceleration.
Solenoid valve 1 Op.circ/grnd short	6	1211	Test solenoid-operated valve 1 and actuation lead for open-circuit (op. circ.) and short-circuit to ground. Resistance of solenoid-operated valve winding:	16	 22... 60 Ω

SELF-DIAGNOSIS TEST TABLE (CONTINUED)

Pocket system tester Fault indication	Fault code	Flashing code	Test instructions / Test conditions	Terminals	Set values
Solenoid valve 2 Op.circ/grnd short	7	1212	Test solenoid-operated valve 2 and actuation lead for open-circuit (op. circ) and short-circuits to ground. Resistance of solenoid-operated valve winding:	17	22...60 Ω
Solenoid valve 1/2 Op.circ./sh. circ.	8	1213	Test actuation leads of both valves for open-circuits (op. circ.), short-circuits to ground and mutual short-circuit (short circ.)	16 17	——
Solenoid valve Reverse gear block Op.circ/grnd short	9	1214	Test solenoid-operated valve for reverse-gear block and actuation lead for open-circuit (op. circ) and short-circuits to ground: Resistance of solenoid-operated-valve winding:	20	22...60 Ω
Solenoid valve 1/ reverse gear block Op.circ./sh. circ.	10	1221	Test actuation leads of both valves for open-circuits (op. circ.), short-circuits to ground and mutual short-circuit (short circ.)	16 20	——
Solenoid valve 2/ Reverse gear block Op.circ/sh.circ.	11	1222	Test actuation leads of both valves for open-circuit (op. circ.), short-circuits to ground and mutual short-circuits (sh.circ.)	17 20	——
Solenoid valves Op.-circ./sh.circ.	12	1223	Test actuation leads of following valves for open-circuits (op.circ.), short circuits to ground and mutual short-circuits: Solenoid-operated valve 1, 2, reverse-gear block. Additionally test actuation lead of solenoid-op. valve, converter clutch for short-circ. to positive. Resistance of solenoid-operated-valve winding:	16 17 20 25	22...60 Ω
Solenoid valve Converter clutch Op.circ/grnd short	13	1224	Test sol.-op. valve for converter clutch and actuation lead for open-circuit (op. circ.) and short-circuit to ground. th Resistance of solenoid-operated-valve winding:	25	22...60 Ω
Solenoid valve 1/ Converter clutch Op.circ./sh.circ.	14	1231	Test actuation leads of both valves for open-circuits (op. circ.), short-circuits to ground and mutual short-circuit (sh.circ.)	16 25	——
Solenoid valve 2/ Converter clutch Op.circ./sh.circ.	15	1232	Test actuation leads of both valves for open-circuits (op. circ.), short-circuits to ground and mutual short-circuit (sh.circ.)	17 25	——

SELF-DIAGNOSIS TEST TABLE (CONTINUED)

Pocket system tester Fault indication	Fault code	Flashing code	Test instructions / Test conditions	Terminals	Set values
Sol. valves 1/2/ Conv.cl./Rev.gr.blk. Op.circ./sh.circ.	16	1233	Test actuation leads of following valves for open-circuits (op. circ.), short-circuits to ground and mutual short-circuits (sh. circ.): Solenoid-operated valve 1, 2, converter clutch (conv. cl.) Test actuation lead of solenoid-operated valve, reverse-gear block (Rev.gr. blk.) for short-circuit to positive. Resistance of solenoid-operated-valve winding:	16 17 25 20	22...60 Ω
Solenoid valve conv.cl./rev.gr.blk. Op.circ./sh.circ.	17	1234	Test actuation leads of both valves for open-circuits (op. circ.), short-circuits to ground and mutual short-circuit (sh.circ.).	20 25	——
Sol. valves 1/2 Conv.cl./Rev.gr.blk. Open-circ/sh. circ	18	1241	Test actuation leads of following valves for open-circuits (op. circ.), short-circuits to ground and mutual short-circuits (sh.circ.): Solenoid-operated valve 1, reverse-gear block (Rev. gr.blk.), converter clutch (Conv. cl.). Test actuation lead of solenoid-operated valve 2 for short-circuit to positive. Resistance of solenoid-operated-valve winding:	16 20 25 17	22...60 Ω
Sol. valves 2/1 Conv.cl./Rev.gr.blk. Op.circ./sh.circ.	19	1242	Test actuation leads of following valves for open-circuits (op. circ.), short-circuits to ground and mutual short-circuits (sh.circ.): Solenoid-operated valve 2, reverse-gear block (Rev. gr.blk.), converter clutch (Conv. cl.). Test actuation lead from solenoid-operated valve 1 for short-circuit to positive. Resistance of solenoid-operated-valve winding:	17 20 25 16	22...60 Ω
Power supply Sol.val./press. reg. Op.circ./sh.circ.	20	1243	Test positive supply of solenoid-operated valves (sol. val.) and pressure regulator (press. reg.). Measure voltage at detached plug of transmission plug connection (connection 2) with ignition switched on:	1	Battery voltage
Eng.-speed signal incorrect/no signal	21	1131	Fault: incorrect/no Tr signal from Motronic. Test signal with engine running using oscilloscope:	21	Needle pulses

SELF-DIAGNOSIS TEST TABLE (CONTINUED)

Pocket system tester Fault indication	Fault code	Flashing code	Test instructions / Test conditions	Terminals	Set values
Pressure regulator Op.circ./sh.circ.	22	1244	Test pressure regulator and actuation lead for short-circuit to positive, short-circuit to ground and open-circuit (op. circ.). Resistance of solenoid-operated-valve winding:	22	1,7...4,5 Ω
Spark-advance angle intervention not in operation	23	1132	Fault: No or permanent ignition-angle intervention. Possible causes: Open-circuit or short-circuit to ground in lead between GS control unit term. 24 and Motronic term. 51 or Motronic control unit defective.	24	Negative rectangular pulse (on shifting gear)
Pwr. take-off sp/ downshift prevention Comparison not O.K.	24	1411	Fault: On account of an implausible output speed the anti-shiftdown unit in the control unit was activated, so as to prevent shiftdown. Resistance of output-speed sensor:	8 27	0,7...1,8 k Ω
Overspeed-prevent function active	25	1412	Fault: Engine raced or Tr signal incorrect. Possible causes: Loose contact in lead to Motronic term. 3 or Motronic control unit defective. Test signal with engine running using oscilloscope:	21	Needle pulses
Injection signal incorrect/no signal	26	1133	Fault: Incorrect or no ti signal from Motronic. Test signal with engine running using oscilloscope:	11	Injection signal
Power take-off speed/engine speed Comparison not O.K.	27	1413	Fault: Ratio of output speed to engine speed not within tolerance. Possible causes: 1. Output-speed sensor defective or lead come off. 2. Transmission-oil level below min., incorrect transmission oil or converter defective. Resistance of output-speed sensor:	8 27	0,7...1,8 k Ω
No fault stored		4444 or 1444	Continue trouble-shooting with trouble-shooting chart.	———	———

TEST SPECIFICATIONS

The stated test specifications apply to measurements directly at the component or at the 35-pin plug.

RPM sensor (in transmission): 0,7...1,8 k Ω

Pressure regulator (in transm.): 1,7...4,5 Ω

Solenoid-operated valves (in transmission)
Solenoid-operated valve-1 and solenoid-operated valve 2, reverse-gear lock and converter clutch, each: 22...60 Ω

Kick-down switch actuated: approx. 0 Ω

Selector switch in position :

	1	2	3	D	N	R	P
Term.18	UB	UB	0	0	0	UB	UB
Term.28	0	0	0	0	UB	0	UB
Term.29	UB	0	UB	0	UB	0	0
Term.30	0	0	0	UB	0	UB	0

UB = Battery voltage (switch on ignition)

Program switch in position
S (term.4), E (term.14) and M (term.15) actuated
Resistance to ground : approx. 0 Ω in each case

Throttle-valve potentiometer:

Total resistance between pin 1 and pin 2 : 3...5 k Ω

Wiper resistance between pin 3 and pin 2 (Potentiometer removed and at idle stop) : 250...800 Ω

For production reasons:
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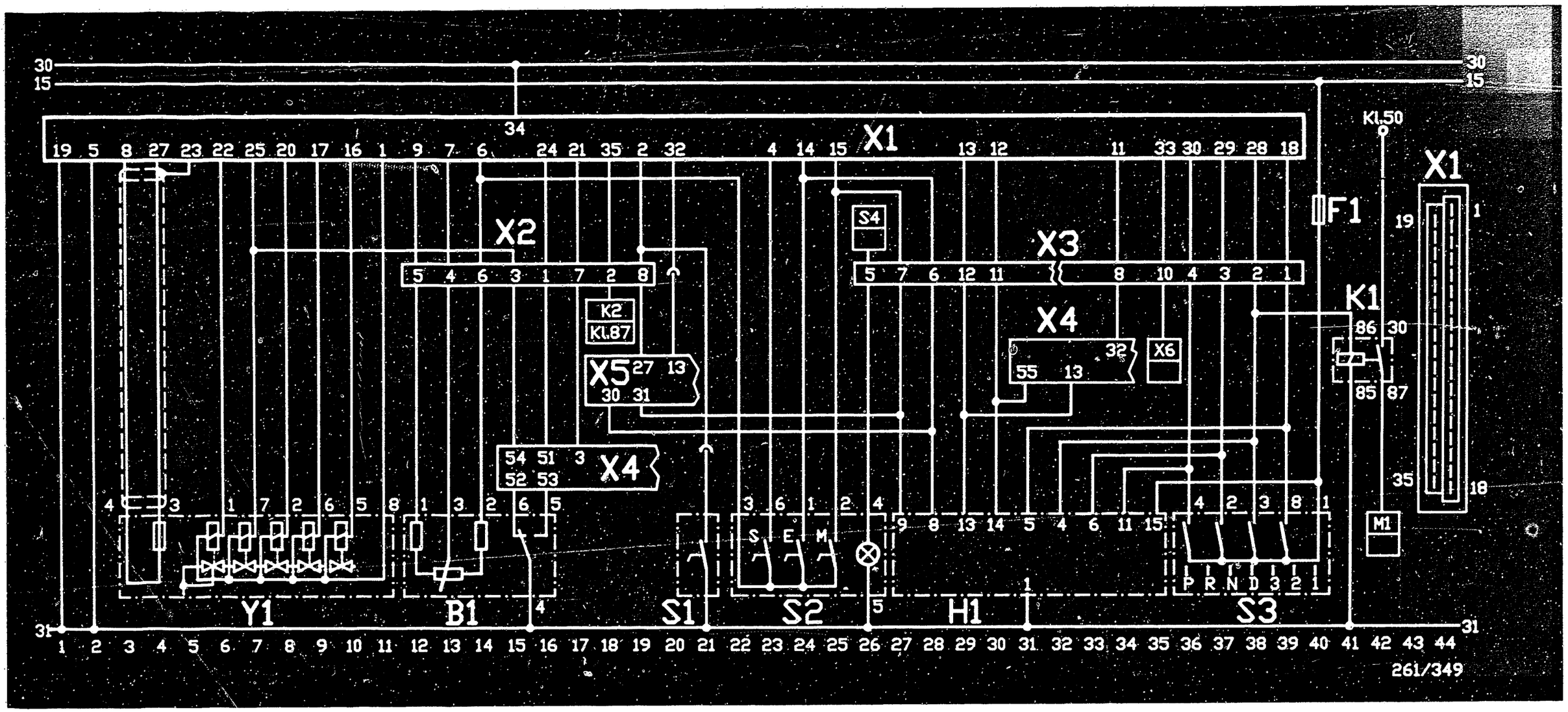
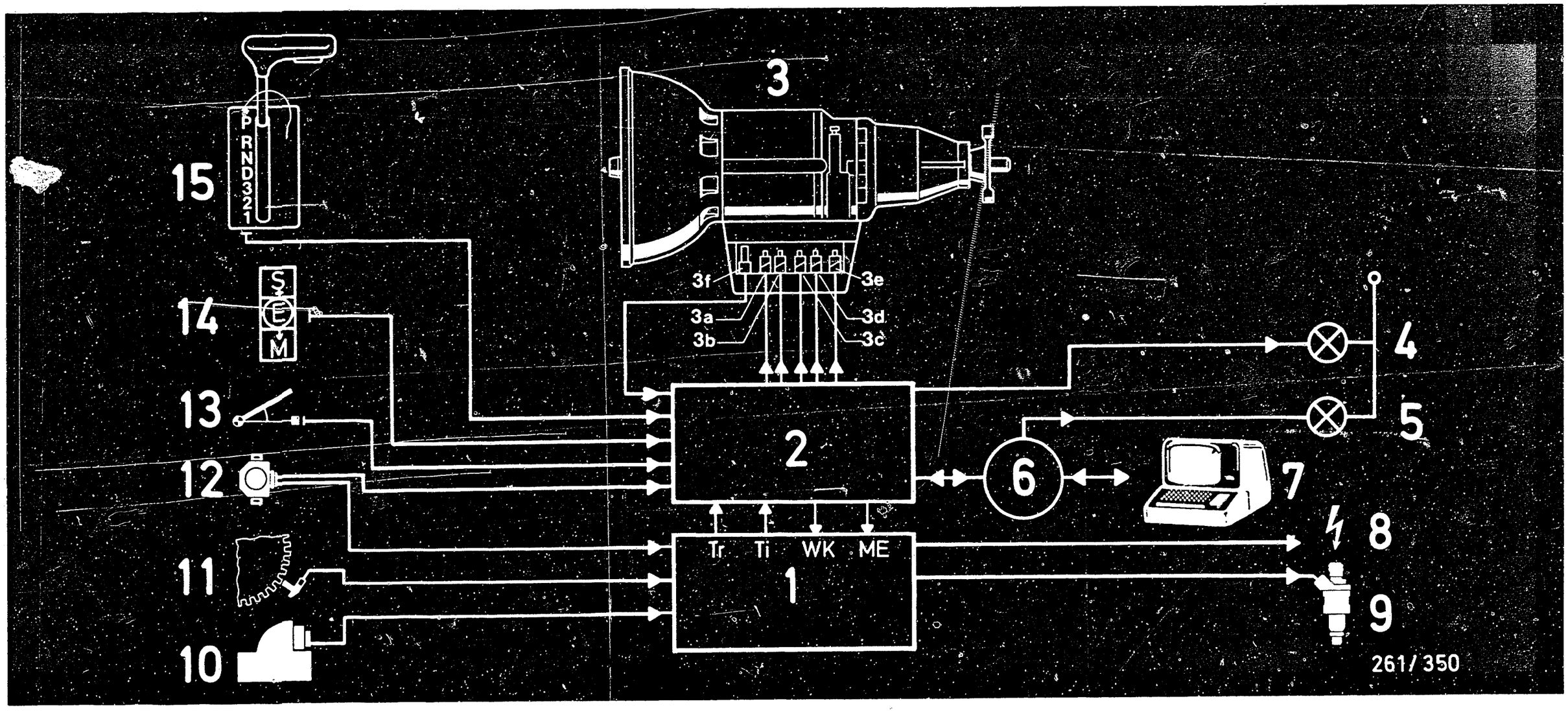


ELECTRICAL TERMINAL DIAGRAM (730i, 735i)

B1 = Throttle-valve sensor
F1 = Fuse (F17 / 7.5 A)
H1 = Instrument cluster (with display for selector/ program switches)
K1 = Starting-interlock relay
K2 = Main relay
M1 = Starting motor
S1 = Kick-down switch
S2 = Program switch
S3 = Selector switch
S4 = Light switch
X1 = GS control-unit plug
X2 = 8-pin plug-in connection to Motronic (electrics box)
X3 = Plug-in connection to instrument wiring harness
X4 = Motronic control-unit plug
X5 = Electronic-accelerator control-unit plug (if electronic accelerator fitted, no B1)
X6 = Check-control-module plug
Y1 = Transmission part with shift valves, pressure regulator and RPM sensor (8-pin round plug on transmission)

M19 ⟹
M20 ⟸



BASIC CIRCUIT DIAGRAM

1 = Motronic control unit
2 = Electronic-transmission control unit
3 = Transmission
3a= Solenoid-operated valves for gear shifting
3b= Solenoid-operated valve - reverse-gear lock
3c= Solenoid-operated valve -converter clutch
3d= Pressure regulator
3e= RPM sensor

4 = Check control
5 = Fault lamp for flashing-code output
6 = Diagnosis socket
7 = Diagnostic tester
8 = Ignition
9 = Injection
10 = Air-flow sensor
11 = Engine-speed sensor
12 = Throttle-valve sensor
13 = Kick-down switch
14 = Program switch

15 = Selector switch

T_r = Engine-speed information
T_i = Load information
WK = Converter-clutch information
ME = Engine-torque reduction (ignition-timing retard)

INSTALLATION POSITION OF COMPONENTS (7351)

Control unit for electronic transmission control:
in A-pillar, right

Engine-speed sensor, switching valves, pressure regulator:
in transmission

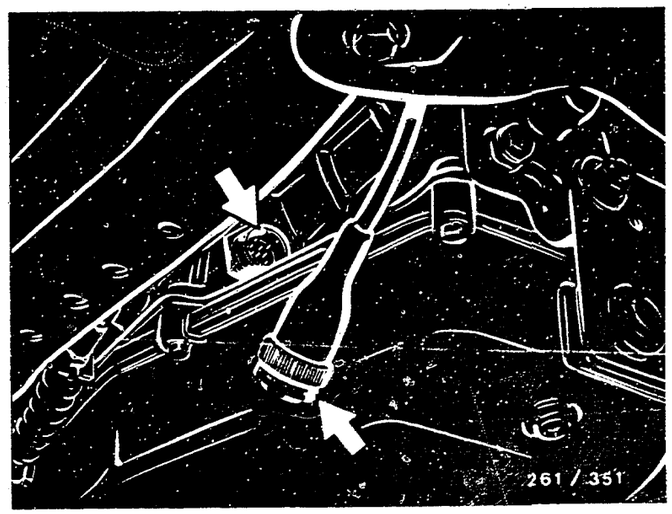
Connectors for engine-speed sensor, switching valves, pressure regulator:
on transmission (top picture; arrows)
See center picture for plug assignment

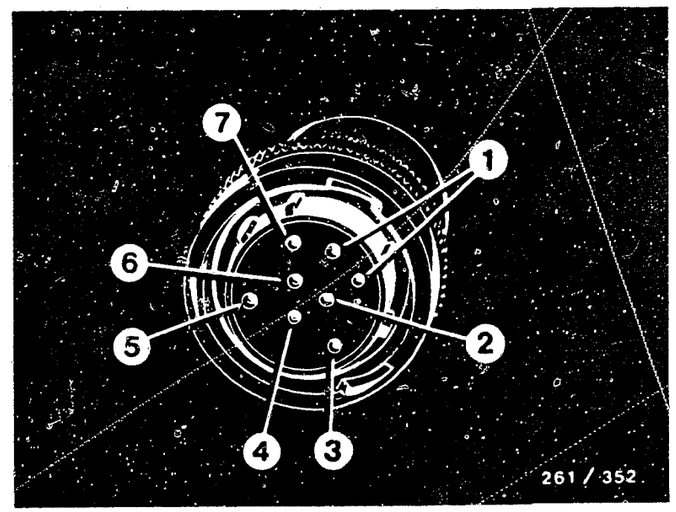
1 = Engine-speed sensor
2 = Voltage supply (10...15 V)
3 = SV-1
4 = SV-2
5 = Pressure regulator
6 = SV-C
7 = SV-R

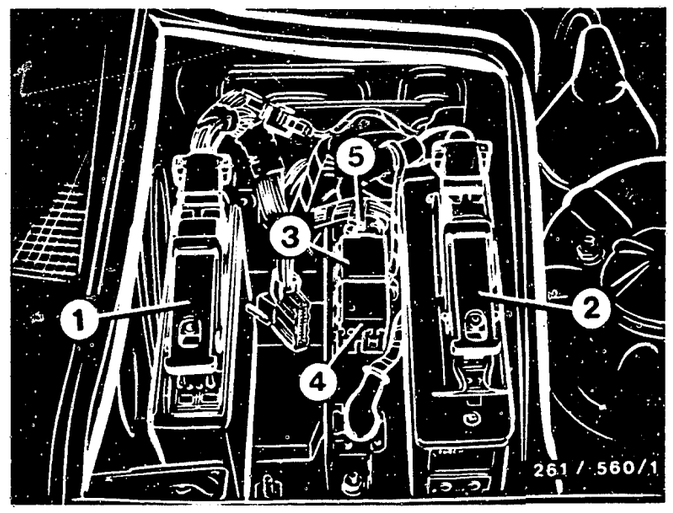
Main relays for transmission control and Motronic:
in E-box (bottom picture; item 3)

Plug connection (8-pole) to Motronic wiring harness:
in E-box (bottom picture; item 5)

Kick-down switch:
beneath accelerator pedal







INSTALLATION POSITION OF COMPONENTS (CONTINUED)

Position switch:
On control console (top picture)

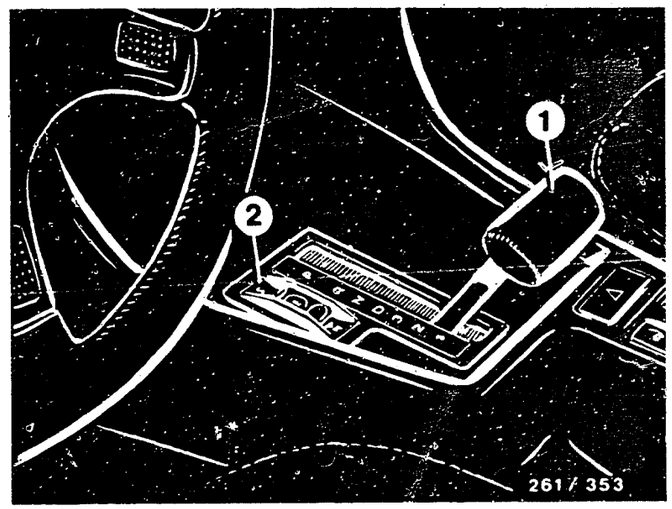
Program button:
On control console (top picture)

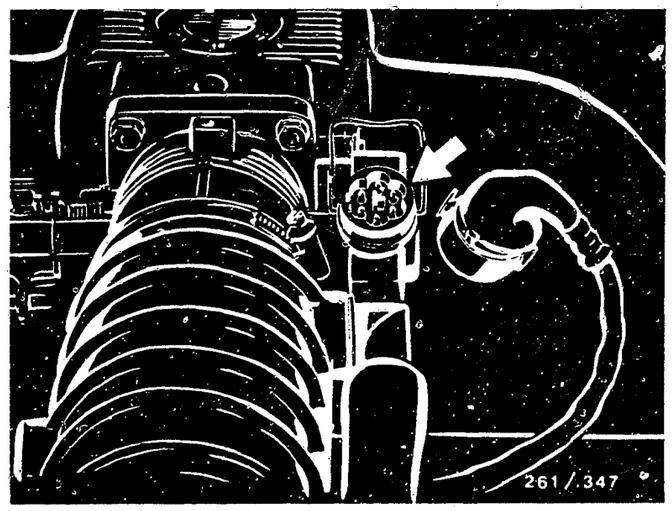
Throttle-valve potentiometer:
At throttle-valve assembly (center picture, arrow)
N o t e :
Adjustment is effected by way of idle contact. Then check voltage at plug between term. 3 and term. 2 - switch on ignition;
Accelerator pedal in off position: < 1 V
Accelerator pedal fully depressed: > 4 V

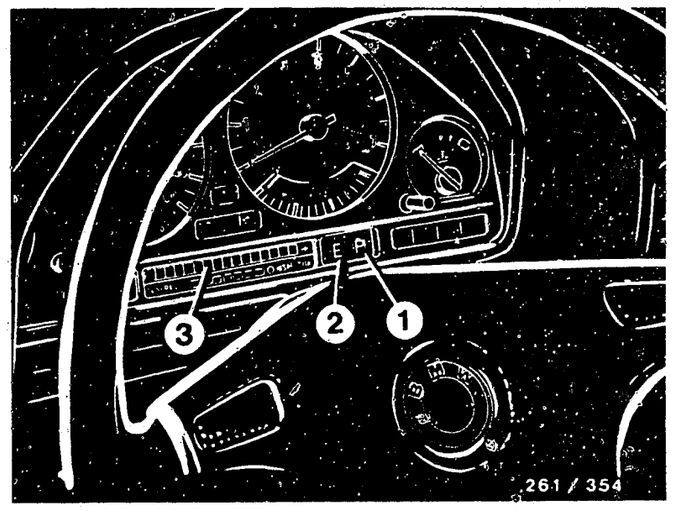
Display unit for position switch and program button:
In instrument panel (bottom picture, items 1 and 2)

Malfunction display for electronic transmission control:
Check control; display "transmission"
(bottom picture, item 3)

Diagnosis socket:
Engine compartment, right-hand bulkhead







Trouble-shooting instructions : BMW-5016

BOSCH system : Motronic M 1.3

Make of vehicle : BMW

Basic microcard : PKW-052

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SPECIAL FEATURES

These trouble-shooting instructions, valid at the time of publication, apply to the following vehicle models:

* BMW 318i with and without cat. conv. as of 09.87
  Engine: 1.8 l / 4 cyl.

* Motronic system M 1.3 with self-diagnosis and flashing-code output (55-pole plug).

* The fault memory can be read out using the Pocket System Tester KTS 300 (0 684 400 300) with the program module PPG 204 as of status 09.01.89.

  Note:
  Further diagnosis possibilities (actuator diagnosis etc), which would be feasible with newer program-module statuses, are not evaluated with these vehicles.

  Pay attention to operating instructions for KTS 300. Connection of the KTS 300 to the diagnosis socket in the vehicle is via the adapter lead 1 684 463 196 (BMW).

* As an alternative to the KTS 300, the self-diagnosis can be read out by way of a flashing code (not possible with all control units).

* The self-diagnosis test table takes account of both the KTS 300 and the flashing code and is arranged according to fault-code nos. indicated by the KTS 300. In some cases, the "fault indication" column includes two types of fault which can be optionally indicated by the tester, e.g.:
  Open-circuit/short-circuit to ground (= 1st type of fault)
  Short-circuit to positive (= 2nd type of fault)

SPECIAL FEATURES (CONTINUED)

* Initiation (stimulation) and continuation of the flashing-code fault output are effected by pressing the full-load switch 5 times (full throttle 5 times within 5 seconds with ignition switched on).
  Each flashing code is output continuously until continuation is effected in each case.
  As the last step the flashing code 0 0 0 0 or 1 0 0 0 appears = end of output.
  The fault memory is cleared by closing the full-load switch for at least 10 seconds during output of the flashing code "end of output".
  Termination of self-diagnosis: Switch off ignition.

* Control unit with variant encoding.
  Important:
  Refer to basic instructions for information which has to be given when ordering control unit.

* Control unit with built-in hold circuit (for tank ventilation valve).

* Adaptive idle-speed regulation with single-winding rotary actuator.

* Group injection: Division into 2 groups which inject at different times (except in warm-up phase and on acceleration).
  Synchronization effected by way of sensor on ignition cable of cyl. 4.
  Group 1: Cylinders 2, 4
  Group 2: Cylinders 1, 3

* Adaptive lambda closed-loop control and tank ventilation with pulsed valve (for cat.).

STRUCTURE AND USAGE

These brief instructions encompass essentially vehicle-specific special features and test specifications (set values).

In accordance with the customer complaint, the trouble-shooting chart leads to different causes/component faults.
For a detailed description of trouble-shooting, see the information in the trouble-shooting chart of the basic instructions.

ATTENTION: Even if reference is made to basic instructions, the set values, terminal assignments and special features of these vehicle-related brief instructions are always binding.

SAFETY AND PRECAUTIONARY MEASURES

In order to keep persons out of danger and to avoid damage to the engine, trigger boxes and control units or to the ignition system, observe the information in the basic instructions.

CAUTION!
High-performance ignition system with dangerous primary and secondary voltages!

Touching voltage-carrying components or terminals may prove fatal (both on the primary and secondary sides).

* Avoid injection of fuel and high-voltage flashovers when testing the compression.
  Therefore, disconnect Motronic relay.

TROUBLE-SHOOTING CHART

Customer complaints (symptoms of trouble)

1. Starting motor operates, engine fails to start or starts only with difficulty.	2. Engine starts but but then dies.	3. Rough idling (engine speed, exhaust gas).	4. Poor throttle response, flat spot during acceleration.	5. Engine misfiring (ignition, fuel injection).	6. Maximum engine power/ top speed not reached.	7. Fuel consumption too high.	8. Engine running on (dieseling).	9. Engine pinging/knocking.	10. Engine overheating.	11. Fault lamp.	Cause (component fault)
*	*	*	*	*	*	*	*	*	*		Self-diagnosis
*											Voltage at control unit
*											Engine-speed/reference mark sensor
*		*			*	*					Fuel pressure
*		*				*	*				Solenoid-operated injection valves
		*	*		*						Throttle-valve switch
	*	*	*	*	*	*					Air-flow sensor
	*	*	*								Idle actuator
*	*	*	*								Air-intake system
		*									Idle speed, CO
*		*		*	*						Ignition coil
*		*	*	*	*						Primary signal
		*	*	*	*	*					Secondary pattern
*	*	*	*		*	*		*	*		Ignition point
*				*							High-voltage sensor
		*									Overrun cut-off
		*	*	*							Interference-suppression resistors
		*	*	*							Noise test
					*						Interference
					*						Throttle valve
					*						Fuel delivery
	*	*	*				*				Tank vent
		*	*								Lambda closed-loop control
*	*	*	*	*	*	*	*	*	*		Control unit

N05 —— => <=

For production reasons: continued on the following coordinate.

N06 —— => <=

SELF-DIAGNOSIS TEST TABLE

Pocket system tester Fault indication	Fault code	Flashing code	Test instructions / Test conditions	Terms.	Set values
Data exchange not possible	—	——	Prerequisite for fault output: leads to diagnosis plug/fault lamp and power supply for control unit O.K.	13 55 15	——
Control unit Digital sec.(comput) defective	1	1211	Control unit defective.	—	——
Relay Fuel pump Op.circ/grnd short Short to B+	3	1261	Fault 1: Short-circuit to ground or open-circuit (op.circ). Fault 1 is only detected if other output stages are defective. Fault 2: Short-circuit to positive (short to B+): Detach pump relay and measure voltage (with respect to ground) in frame (term. 86) with ignition on: Resistance of relay coil (term. 85/86): Test lead to control unit (term. 3).	3	10...15 V approx. 50...150 Ω
Idle actuator ZWD winding 1/EWD Op.circ/grnd short Short to B+	4	1262	Test leads and plug connection of actuator for open-circuit (op. circ), short-circuit to ground and short-circuit to positive (short to B+). Winding resistance at +15...+30°C:	4	approx. 8 Ω
Valve Tank ventilation Op.circ/grnd short Short to B+	5	1263	Only CAT models have tank ventilation valve. Test lead for contact with ground or positive. Valve winding resistance at +15...+30°C: If lead and valve O.K., then control unit is defective. Open-circuit (op. circ) is not detected!	5	35...55 Ω
Air-flow sensor/ Air-mass sensor Signal too low Signal too high	7	1215	Signal too low: Test lead to term. 2 for short-circuit to ground. Open-circuit in leads to term. 2 and term. 3 or term. 4 and term. 3 jumpered. Signal too high: Test lead to term. 4 for open-circuit. Test leads to term. 4 and term. 2 for short-circuit to positive. Continued on next Coordinate.	7 12 26	——

SELF-DIAGNOSIS TEST TABLE (CONTINUED)

Pocket system tester Fault indication	Fault code	Flashing code	Test instructions / Test conditions	Terms.	Set values
Air-flow sensor/ Air-mass sensor Signal too low Signal too high			Basic tests: Test resistances at air-flow sensor: between term. 2 and term. 4 (deflect sensor flap) between term. 3 and term. 4: Measure wiper voltage at term. 2 with plug attached and ignition switched on: Sensor flap in off position: Slowly deflect sensor flap as far as full load:		8...2500 Ω 500...1100 Ω 0,2...0,3 V greater than 4,2 V
Lambda control outside max. range outside max. range	10	1222	Test CO content (ahead of cat. conv.): Test intake system for leaks. Test fuel pressure. Injection valves defective. Sensor defective.	—	0,2...1,2 vol.%
Fault lamp Op.circ/grnd short Short to B+	15	—	Test lead to fault lamp (if applicable) for short-circuit to ground and short-circuit to positive (short to B+). Open-circuit (op. circ) is not detected!	15	—
Injectors (Group 1) Op.circ/grnd short Short to B+	16	1252	Fault: Short-circuit to ground, to UB (short to B+) or open-circuit (op. circ) in joint positive/negative lead. Test injection valves of cyl. 2 and 4 for short-circuit/open-circuit; if O.K.: control unit defective Note: Open-circuits in individual injection valves are not detected.	16	7... 9 Ω (2 valves in parallel) 14...17 Ω (1 injection valve)
Injectors (Group 2) Op.circ/grnd short Short to B+	17	1251	Fault: Short-circuit to ground , to UB (short to B+) or open-circuit (op. circ) in joint positive/negative lead. Test injection valves of cyl. 1 and 3 for short-circuit or open-circuit; if O.K., control unit defective Note: Open-circuits in individual injection valves are not detected.	17	7... 9 Ω (2 valves in parallel) 14...17 Ω (1 injection valve)

SELF-DIAGNOSIS TEST TABLE (CONTINUED)

Pocket system tester Fault indication	Fault code	Flashing code	Test instructions / Test conditions	Terms.	Set values
Relay Sensor heater Op.circ/grnd short Short to B+	23	1264	Detach relay and measure voltage (with respect to ground) in frame (term. 86) with ignition switched on: Resistance of relay coil (term. 85/86): Test lead to control unit (term. 23).	23	Battery voltage approx. 50...150 Ω
Lambda sensor Open circuit Grnd short Short to B+	28	1221	Test lead for open-circuit (op. circ.), short-circuit to ground and short-circuit to positive (short to B+). Watch out for worn cable insulation! Sensor heater defective. Sensor clogged.	28	——
Battery voltage too low too high	37	1231	Supply voltage for control unit too low: Test voltage dips at positive and ground terminal. Charge battery. Supply voltage for control unit too high: Test alternator regulator.	18 19 (+)(-)	greater than 9 V (with engine running) less than 16 V (with engine running)
Air cond. readiness/AC compr. sign. Comparison not O.K.	40	——	Test lead from control unit term. 40 to A/C compressor for short-circuit to positive. Test lead from control unit term. 41 to A/C switch (A/C readiness) for open-circuit.	40 41	——
CO potentiometer Signal too low Signal too high	43	1268	Note: CO potentiometer is only active on models with no lambda closed-loop control. Signal too low: Test lead to air-flow sensor term. 1 for open-circuit and short-circuit to ground. Signal too high: Test same lead for short-circuit with voltage-carrying lead. Test potentiometer (and CO). To do so, measure voltage at air-flow sensor term. 1 with ignition switched on:	43	0.8...4.5 V
Air-temp. sensor Op.circ./sh. to B+ Short to ground	44	1224	Test temperature sensor and lead for open-circuit (op. circ.), short-circuit to ground (short to ground) and short-circuit to pos. (sh. to B+). Temperature sensor resistance: at +15...+30°C:	44	1450...3300 Ω

SELF-DIAGNOSIS TEST TABLE (CONTINUED)

Pocket system tester Fault indication	Fault code	Flashing code	Test instructions / Test conditions	Terms.	Set values
Engine temp. sensor Op. circ./sh. to B+ Short to ground	45	1223	Test temperature sensor and lead for open-circuit (op. circ.), short-circuit to ground (short to ground) amd short-circuit to positive (sh. to B+). Temperature-sensor resistance: at +15...+30°C: at approx. +80°C:	45	1450...3300 Ω 280... 360 Ω
Idle switch Short to ground	52	1232	Fault: Idle contact (in throttle-valve switch) permanently closed or short-circuit to ground in lead. Idle contact closed in off position: Actuate throttle valve somewhat :	52	approx. 0 Ω infinity Ω
Full-load switch Short to ground	53	1233	Fault: Full-load contact (in throttle-valve switch) permanently closed or short-circuit to ground in lead. Full-load contact closed in full-throttle position: Release accelerator pedal somewhat:	53	approx. 0 Ω infinity Ω
CU output stages with fin.cntling el. defective	100	——	CU = Control unit. Test following components and leads for open-circuit, short-circuit to ground and short-circuit to positive: Idle actuator, injection valves, fuel pump relay, tank ventilation valve and fault lamp if fitted.	4 22 16 17 3 5 15	——
No fault stored		4444 or 1444	Continue trouble-shooting with trouble-shooting chart.	—	——

Pressure regulator	
Fuel pressure	2,8...3,2 bar
Electric fuel pump	**Fuel delivery**
(measured in return)	at least 650 cm ^{3} /30s
Supply voltage (under load):	at least 12 V
Temperature sensor (intake air)	
Internal electrical resistance measured at air-flow sensor between term.5 and term.4	
at ambient temperature (+15°C...+30°C):	1450...3300 Ω
Temperature sensor (engine) (plug color, blue)	
Internal electrical resistance	
at + 15° C...+ 30° C :	1450...3300 Ω
with engine at norm. op. temp. (approx. + 80° C):	280...360 Ω
Solenoid-operated injection valve	
Internal electrical resistance at ambient temperature (+ 15° C...+ 30° C):	14,5...17 Ω
Air-flow sensor	
Internal electrical resistance between:	
term.2 and term.4 :	8...2500 Ω (*)
term.3 and term.4 :	300... 550 Ω
term.1 and term.4 (CO potentiometer):	
Minimum	0... 30 Ω
Maximum: the actual value measured between term. 3 and term. 4 may be up to 30 Ohms less.	

(*) Slowly deflect air-flow sensor flap as far as it will go. Resistance fluctuates between the terminals of the potentiometer.

Engine-speed/reference-mark sensor	
Internal electrical resistance between term.1 and term.2 at ambient temperature (+15°C...+30°C):	400...800 Ω
Air gap:	0,8 ± 0,5 mm
Throttle-valve switch	
Resistance value of idle contact (term.2 and term.18):	0 Ω
Resistance value of full-load contact (term.3 and term.18):	0 Ω
Idle actuator	
Internal electrical resistance at +15°...+30°C :	Approx. 8 Ω
Lambda sensor	
Resistance value of heater winding (sockets 3 and 4 in the 4-pin terminal to lambda sensor):	1...15 Ω
Ignition coil	
Primary resistance:	Approx. 0,8 Ω
Secondary resistance:	5000...7200 Ω
Interference-suppression resistors	
High-voltage-distributor rotor:	1 k Ω
High-voltage-distributor dome:	each 1 k Ω
Spark-plug connectors:	each 5 k Ω
Spark plugs:	5 k Ω
Ignition coil:	1 k Ω

TEST SPECIFICATIONS (CONTINUED)

High-voltage sensor:
Internal electrical resistance
between term.1 and term. 2:
Approx. 0 Ω

Tank-ventilation valve:
(in catalytic-converter vehicles only)
Internal electrical resistance at
ambient temperature
(+15°C...+30°C): 35...55 Ω

Idle test:
Engine at normal operating temperature,
switch off loads.
Idle speed: 800 ± 40 min $^{-1}$
Spark-advance angle: 12 ± 5° crankshaft
(Automatic transmission to N or P)

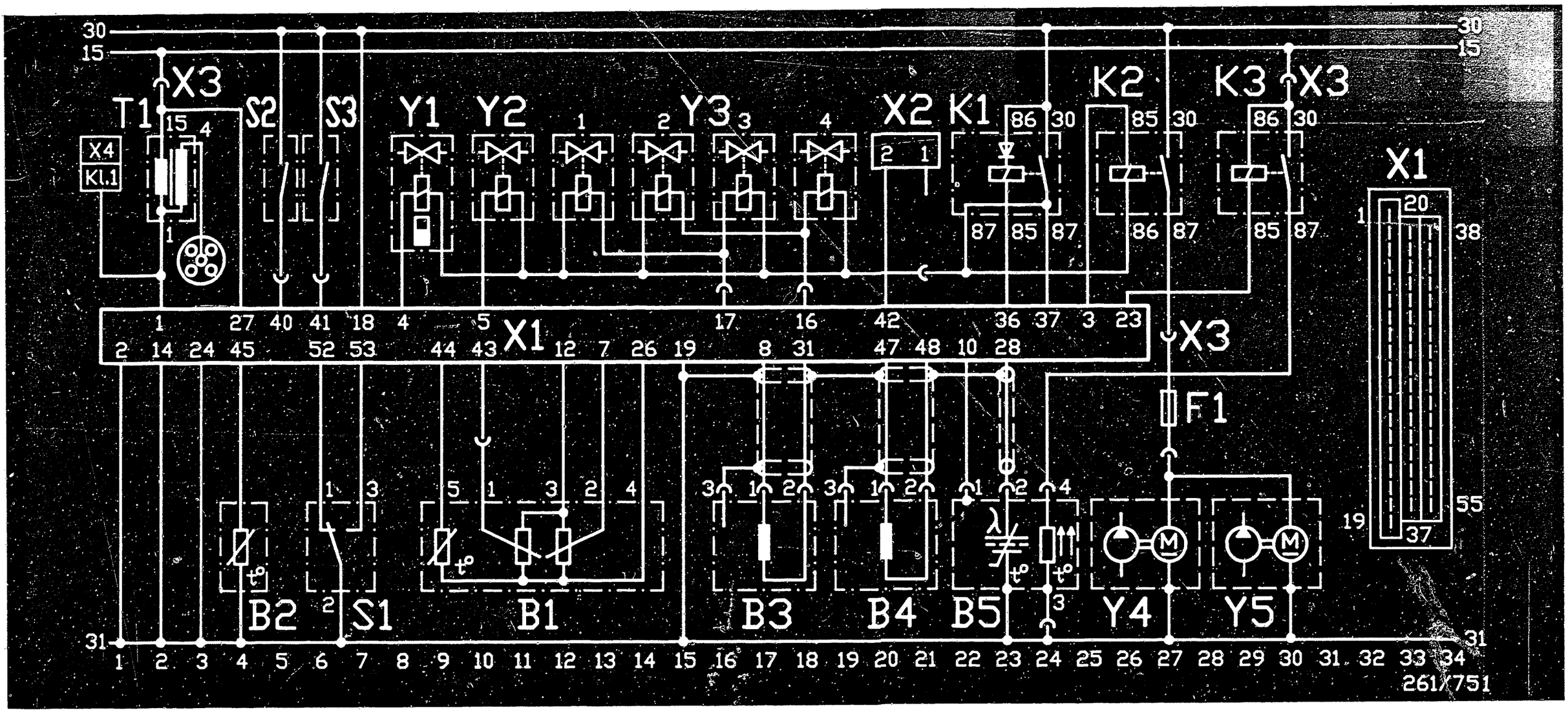
CO content: without
catalytic converter: 0,5...1,5 % CO by vol.
Adjust mixture by means of CO
potentiometer in air-flow
sensor:
turning to the left makes mixture leaner,
turning to the right makes mixture richer.

Max. adjustment of duration
of injection: Approx. 0,6 ms

Catalytic-converter
vehicles: 0,2...1,2 % CO by vol.
(measure CO upstream of the catalytic
converter if sample pickup fitted,
pull apart lambda-sensor plug).

See equipment and Autodata microcards for
the settings for valve clearance and other
engine-related data.

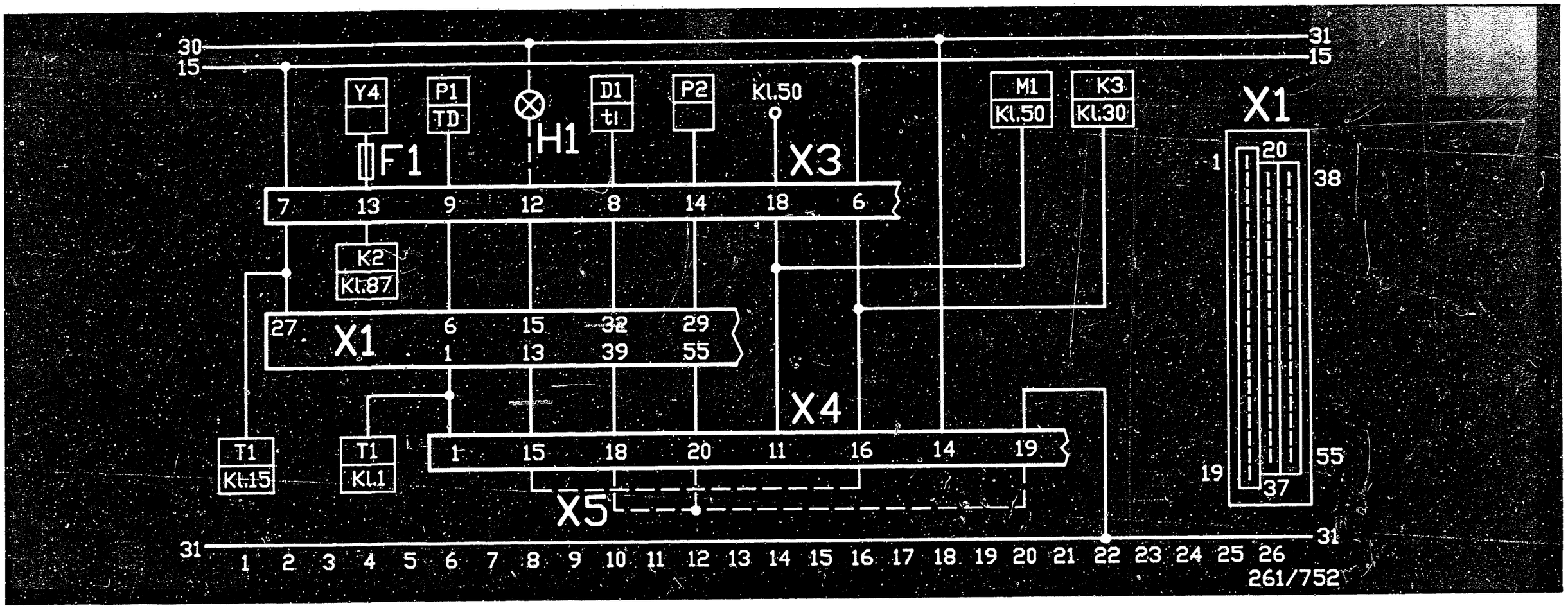
For production reasons:
continued on the following
coordinate.



ELECTRICAL TERMINAL DIAGRAM

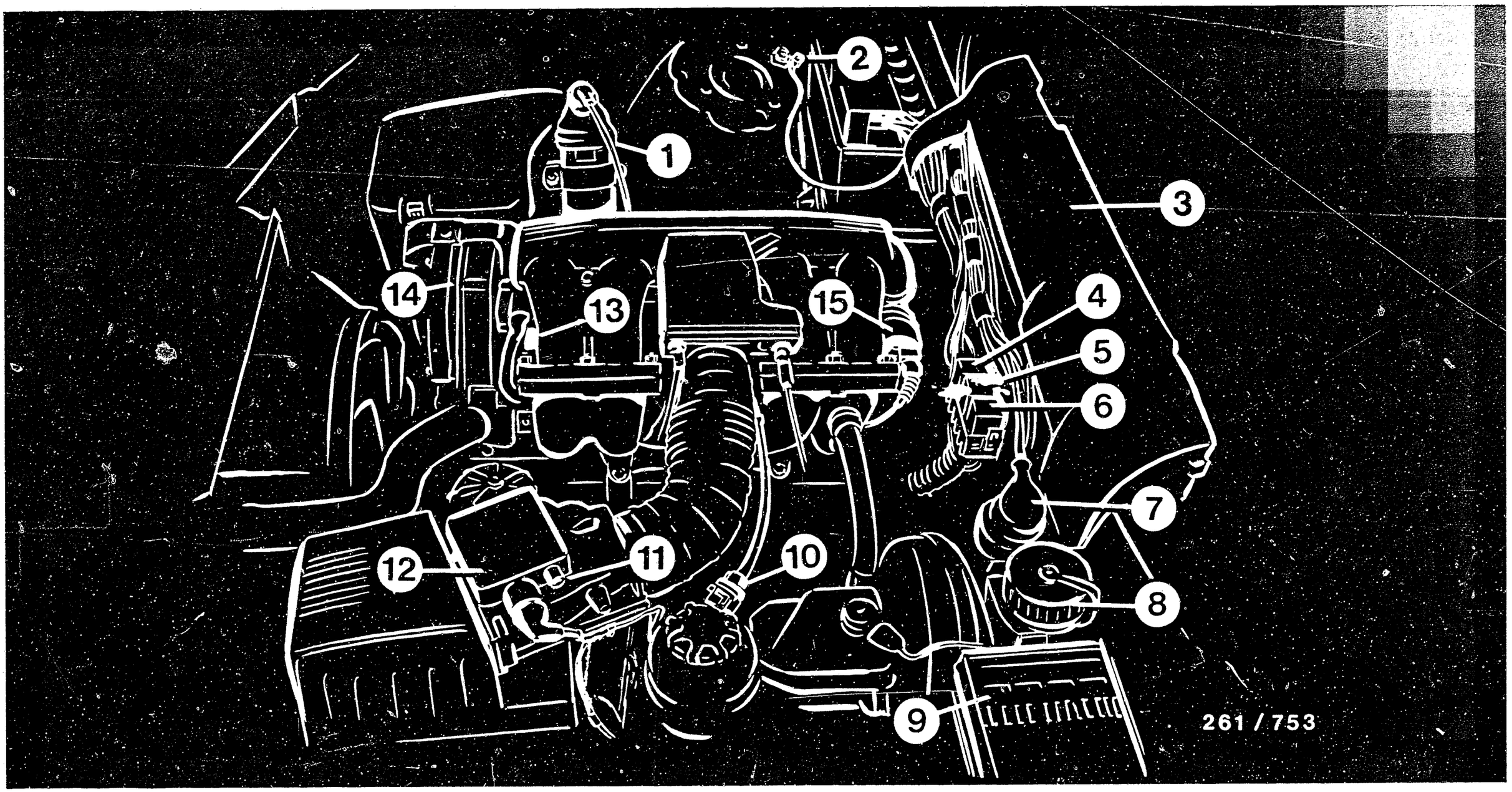
B1 = Air-flow sensor
B2 = Coolant-temperature sensor
B3 = High-voltage sensor
B4 = Engine-speed/reference-mark sensor
B5 = Heated lambda sensor (cat)
F1 = Pump fuse (No. 11)
K1 = Main relay
K2 = Pump relay
K3 = Sensor-heater relay (cat)
S1 = Throttle-valve switch
S2 = Switch on air-conditioner compressor
S3 = Switch on air conditioner
T1 = Ignition coil
X1 = Motronic control-unit plug
X2 = Plug-in connection to automatic transmission (P/N switch)
X3 = Engine plug
X4 = Diagnostic socket
Y1 = Idle actuator
Y2 = Tank-ventilation valve (cat)
Y3 = Solenoid-operated injection valve
Y4 = Electric fuel pump
Y5 = Pre-supply pump (if fitted)

N19 ⟹
N20 ⟺



ELECTRICAL TERMINAL DIAGRAM (Continued – diagnostic and engine plugs)

D1 = On-board computer
F1 = Pump fuse (No. 11)
H1 = Fault lamp; also for flashing code output (presently in US modes only).
K2 = Pump relay
K3 = Sensor-heater relay (cat)
M1 = Starting motor
P1 = Tachometer
P2 = Speedometer
T1 = Ignition coil
X1 = Motronic control-unit plug
X3 = Engine plug
X4 = Diagnostic socket
X5 = Bridge in cover
Y4 = Electric fuel pump



INSTALLATION POSITION OF COMPONENTS

1 = Ignition coil
2 = Motronic ground terminal
3 = Cover over relay
4 = Main relay (white)
5 = Pump relay (orange)
6 = Sensor-heater relay (orange)
7 = Engine plug
8 = Diagnostic socket
9 = Fuse box
10 = Tank-ventilation valve
11 = CO potentiometer
12 = Air-flow sensor
13 = Fuel-pressure regulator
14 = High-voltage distributor
15 = Idle actuator

INSTALLATION POSITION OF COMPONENTS (Continued)

The indications "right" and "left" always refer to the forward direction of travel.

Control unit:
in the glove compartment above the cover (upper illustration, arrow).

Lambda sensor (Cat):
in the common exhaust pipe (center illustration, Item. 1).

Plug-in connection to lambda sensor (round, 4-pin):
near to battery (center illustration, Item 2).

Tank-ventilation valve (Cat):
see lower illustration, arrow.

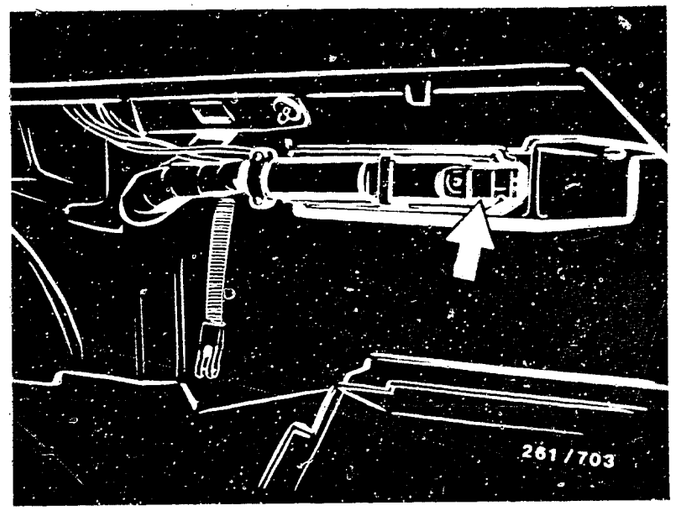
Activated-carbon canister (Cat):
in the engine compartment on the left-hand side next to the fuel filter.

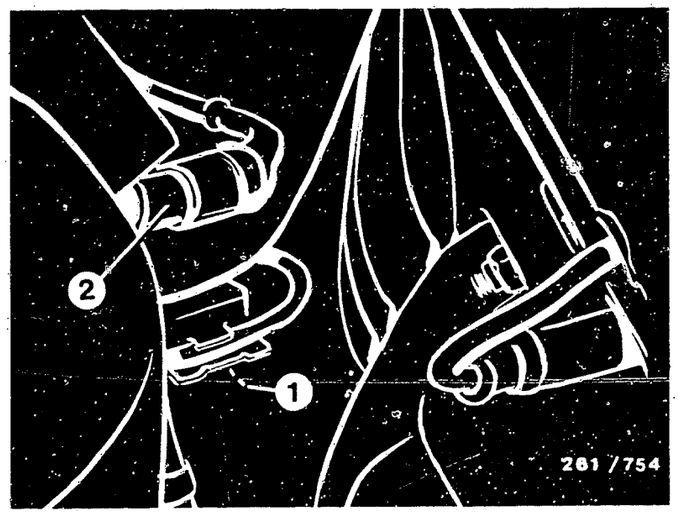
Engine-speed/reference-mark sensor:
at engine, front, to the right of the crankshaft ring gear.

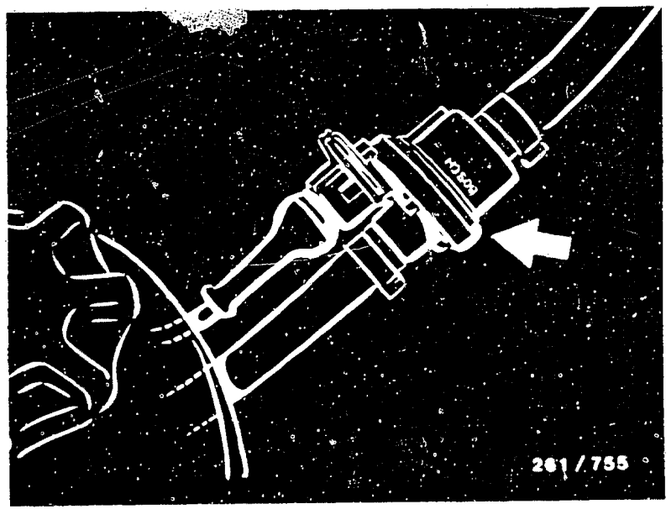
High-voltage sensor:
on high-tension ignition cable to cylinder 4.

Connection point for fuel pressure measurement:
at fuel inlet hose (next to dipstick).

Intake-air temperature sensor:
in air-flow sensor.







INSTALLATION POSTION OF COMPONENTS (Continued)

Electric fuel pump:
beneath the vehicle (upper illustration, Item 1) or in the tank (if in-tank fuel pump).

Fuel-pressure damper:
beneath the vehicle (upper illustration, Item 2).

Fuel filter:
in the engine compartment on the left-hand side, near to firewall (center illustration, Item 1).

Fuse No. 11 for electric fuel pump:
in the fuse box on the firewall on the left (center illustration, Item 2).

Temperature sensor (engine):
screwed into the engine block (lower illustration, arrow).

Throttle-valve switch:
at the bottom of the throttle-valve assembly.